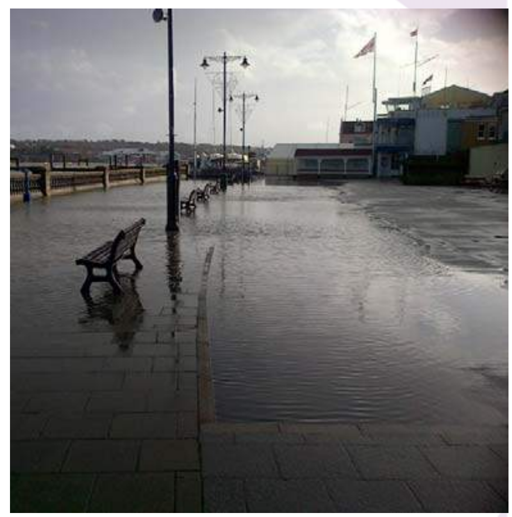
Isle of Wight Level 1 SFRA (2018)



Wood Environment & Infrastructure Solutions UK Limited – December 2018

Report for

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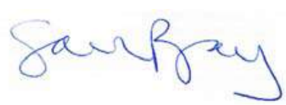

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Management systems

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Document revisions

No.	Details	Date
1	Draft report	17/10/2018
2	Draft for comment	26/10/2018
3	Final	13/12/2018

Contents

1. Introduction

This section of the report describes the organisation of the data in the SFRA and directs readers to the relevant sections and appendices, according to the readers' requirements.

1.1 SFRA overview

1.1.1 This report provides an update to the 2010 Level 1 Strategic Flood Risk Assessment (SFRA) for the Isle of Wight Council.

1.1.2 The National Planning Policy Framework (NPPF) requires local planning authorities (LPAs) to assess the risk of flood in their areas through undertaking a SFRA[1].

1.1.3 This SFRA is intended to inform the development of policies related to flood risk management and the allocation of land for future development. This is achieved through a thorough analysis of flood risk on the Island, enabling an informed response to development proposals and planning, and helping to identify strategic solutions to flood risk.

1.2 Purpose of this Strategic Flood Risk Assessment

1.2.1 A SFRA is produced with the purpose of providing an evidence base to support spatial planning decisions at the LPA scale. The Level 1 SFRA is intended to:

- Identify main rivers and ordinary watercourses;
- Identify fluvial and tidal flood zones on the Island;
- Assess the potential impact of climate change on flood risk;
- Identify areas at risk from other sources of flooding such as surface water, groundwater, reservoirs and other artificial such as sewers;
- Identify existing flood risk management measures including their location and standard;
- Provide guidance on the application of the Sequential Test; and
- Provide guidance on flood risk management through the design process.

1.2.2 Changes and additions to legislation, planning policy and strategy since the SFRA of 2010 are accounted for within this update, such as the National Planning Policy Framework (NPPF) and National Planning Practice Guidance (PPG).

1.2.3 The SFRA takes account of newly available data such as updates to the Environment Agency's (EA's) Risk of Flooding from Surface Water (RoFSW) and updates to the Environment Agency flood zone mapping.

1.2.4 The SFRA provides an updated review of the flood risk on the Island, enabling strategic planning for the allocation of potential future development and underpinning any amendments to planning policy.

[1] NPPF - Paragraph: 001 - https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/740441/National_Planning_Policy_Framework_web_accessible_version.pdf

1.2.5 The SFRA provides updated guidance to prospective developers who will require a site specific Flood Risk Assessment (FRA) to support a planning application. This includes guidance on the appropriate use of Sustainable Drainage Systems (SuDS).

1.3 Scope of update

1.3.1 The 2010 SFRA was a thorough and detailed assessment, informed by bespoke hydrological and hydraulic modelling. As part of a review of the 2012 Island Plan[2] (Isle of Wight Core Strategy) to account for flood risk, the Council met with the EA in October 2017 and confirmed that the Geographical Information Systems (GIS) data that supported the 2010 SFRA remained fit for purpose for the Plan, with the exception of some out of date fluvial flood risk zones and surface water flood mapping. This, combined with the updates to national policy provided in NPPF and PPG, prompted a refresh of the SFRA to provide a flood risk dataset that is consistent with the EA's data and upon which the Strategic Housing Land Availability Assessment (SHLAA) and Island Plan can be based.

1.3.2 To that end, this update will be limited to the following:

- The assimilation of up to date flood risk information, focusing on Island-wide mapping as opposed to the Regeneration and Development Areas (RDAs) assessed in the 2010 SFRA;
- An update to the national flood risk policy guidance and sustainable drainage recommendations;
- A Level 1 Assessment of potential development sites, screened against the latest fluvial and tidal flood zones; and
- An accompanying Level 2 SFRA which focuses on the 14 sites identified using the information in this SFRA as being potentially suitable for residential development.

1.4 Using this SFRA

1.4.1 The SFRA is a tool to inform the spatial planning process and guide safe development, from a flood risk perspective. The information has been presented in such a way to facilitate this objective. Appendix A is a key component of the report, as it includes detailed mapping which is sufficient to inform the application of the Sequential Test.

1.4.2 For the purposes of informing the Sequential Test, the key pieces of information are:

- Figure A3 in Appendix A in conjunction with Table 6.1, showing flood zones and detailing appropriate land uses by zone;
- Section 6 – Information to support the Sequential Test; and
- Sections 7 and 8 – Guidance on appropriate flood risk management.

1.5 Data used in the assessment

1.5.1 Table 1.1 below lists the SFRA data sources, used to characterise flood risk on the Island and to assess the sites put forward for potential allocation.

[2] https://www.iow.gov.uk/azservices/documents/1321-Core%20Strategy%20-%20Adopted%20Mar%202012.pdf

Table 1.1 Information available for use in the SFRA

Description	Source
Flood map for planning – Flood Zones 2 and 3	EA Spatial Data Catalogue
Risk of flooding from surface water	EA Spatial Data Catalogue
Historic flood map	EA Spatial Data Catalogue
Source Protection Zones	EA Spatial Data Catalogue
Main rivers (10k)	EA Spatial Data Catalogue
LiDAR DTM 1m	EA Spatial Data Catalogue
Spatial flood defences	EA Spatial Data Catalogue
Areas of floodplain potentially sensitive to climate change	Created as part of 2018 SFRA
Potential development sites	Isle of Wight Council
Coastal wind and wave exposure risk	Created as part of 2010 SFRA
Projected sea level rise contours	Created as part of 2010 SFRA
Soil HOST classifications	Dataset from 2010 SFRA
SuDS groundwater contamination potential	Dataset from 2010 SFRA
Mass movement	Dataset from 2010 SFRA
Solid and drift geology	Dataset from 2010 SFRA
Groundwater vulnerability	Dataset from 2010 SFRA

1.6 Report Structure

1.6.1 This report comprises the following sections:

- Section 1 – provides an overview of the SFRA, its purpose and structure. The introduction is also designed to provide guidance on how to extract the most information from the SFRA;
- Section 2 – discusses the SFRA in the context of national and local planning policy as revised since 2010;
- Section 3 – provides an overview of all the sources of flood risk that have been identified on the Island together with sources of information;
- Section 4 – describes the method used for assessing the potential impacts of fluvial and tidal climate change;
- Section 5 – describes the method used for assessing the impacts of wind action and wave spray;
- Section 6 – details how flood risk can be managed through the planning process;

- Section 7 – details how flood risk can be managed through the design process;
- Section 8 - outlines the principles of sustainable surface water management on the Island; and
- Section 9 – describes the when a site specific Flood Risk Assessment is required, and how to process windfall site applications.

2. Background information and flood risk policy

This section provides the reader with an overview of the emerging planning policy relevant to the Isle of Wight, describing how and why it provides the context for this assessment.

2.1 Flood risk and planning policy

2.1.1 This SFRA has been prepared in accordance with national planning legislation and policy guidance. The planning process is driven by legislation and guidance developed at a national, regional and local level, of which flood risk is just one of many factors requiring consideration when making decisions relating to land use and development.

2.1.2 The challenge and measure of success for a SFRA is to develop pragmatic principles for steering future development towards areas of lower flood risk within the context of, and in adhering to other planning policies and local drivers.

2.1.3 There have been significant changes to the policy framework used in informing SFRAs since the previous SFRA was published in June 2010. At the national level, Planning Policy Statement 25 (PPS25) was replaced with the National Planning Policy Framework (NPPF) in 2012.

2.1.4 At the local level policy has informed several Island-specific documents, including the Island Plan, Local Flood Risk Management Strategy, Shoreline Management Plan and Catchment Flood Management Plan, described in Section 2.3.

2.2 National planning policy

NPPF (2012) and NPPG (2014)

2.2.1 National planning policy is set out in the NPPF, published by the Government in 2012 and revised in 2018[3]. The NPPF is accompanied by online Planning Practice Guidance (PPG), published in 2014[4], which provides further guidance on specific issues such as flood risk. The NPPF and NPPG supersedes PPS25 and its associated planning practice guidance.

2.2.2 The NPPF covers a full range of planning issues, focusing on the core issue of sustainable development. Highlighted issues are the re-use of previously developed land of low environmental value, promoting economic growth, and transitioning to a low carbon future, with full consideration of any flood risk.

2.2.3 LPA planning processes are underpinned by NPPF which dictates that:

"*Local Plans should apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change, by:*

- *applying the Sequential Test;*
- *if necessary, applying the Exception Test;*

[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/740441/National_Planning_Policy_Framework_web_accessible_version.pdf
[4] https://www.gov.uk/government/collections/planning-practice-guidance

- *safeguarding land from development that is required for current and future flood management;*
- *using opportunities offered by new development to reduce the causes and impacts of flooding; and*
- *where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to facilitate the relocation of development, including housing, to more sustainable locations*."

2.2.4 The Sequential and Exception Tests are detailed in Section 6 of this SFRA.

Flood Risk Regulations (2009) and Flood and Water Management Act (2010)

2.2.5 The Flood Risk Regulations (2009) place responsibility for the management of localised flood risk upon Lead Local Flood Authorities (LLFAs), in this case the Isle of Wight Council.

2.2.6 The management of all flood risk outside of flooding from main rivers, the sea and reservoirs rests with the LLFA.

2.2.7 The duties for the LLFA, as described in the Water Management Act (2010) are as follows:

- Develop, maintain, apply and monitor a Local Flood Risk Management Strategy (LFRMS);
- Investigate and report flooding incidents from any source;
- Establish and maintain a register of structures or features that are likely to have a significant effect on flood risk;
- Designate structures and features that affect flood risk, thereby requiring the owner to seek consent for any alterations to or removal of the structure; and
- Perform consenting of works on ordinary watercourses.

SuDS

2.2.8 As of April 2015[5], LLFAs have the responsibility for ensuring any Sustainable Drainage Systems (SuDS) are of appropriate design standards and have clear arrangements for maintenance over the development's lifetime. Isle of Wight Council must therefore be consulted to provide technical advice on all new major developments, defined as residential development of 10 dwellings or more, or with a site area of 0.5 hectares or more, and non-residential development where floor space created is 1,000 m^2 or more, or with a site area of 1 ha or more.

2.3 Local policy

Island Plan: The Isle of Wight Council Core Strategy (2012)

2.3.1 The Island Plan[6] is the Isle of Wight Council's core strategy document, and is currently being reviewed. There are a number of expectations listed within the Plan, stating that development proposals will be expected to:

- Meet the aims and objectives of the Council's SFRA;

[5] http://www.parliament.uk/documents/commons-vote-office/December%202014/18%20December/6.%20DCLG-sustainable-drainage-systems.pdf

[6] https://www.iow.gov.uk/azservices/documents/1321-Core%20Strategy%20-%20Adopted%20Mar%202012.pdf

- Provide an allowance for climate change when undertaking FRAs, to a minimum time period of 100 years;
- Provide appropriate on-site sustainable drainage systems for the disposal of surface water;
- Produce a Drainage Strategy for all sites over 0.25 hectares in Flood Zone 1; and
- Support the objectives and measures of the relevant flood risk management plans and strategy.

Isle of Wight Local Flood Risk Management Strategy (LFRMS) (2016)

2.3.2 The Isle of Wight LFRMS[7] helps communities and businesses to better understand and manage flood risk on the Island. Actions are assigned to the Council, to the contractors used for emergency flood response, Island Roads and the local community to coordinate the management of flood risk on the Island.

Isle of Wight Shoreline Management Plan (SMP) (2010)

2.3.3 The Isle of Wight SMP[8] sets out policies related to the management of the coastline and the response to coastal flooding and erosion risks over the next 20, 50 and 100 years. The response is broken down into four policies: hold the line, advance the line, no active intervention; and managed realignment.

Isle of Wight Catchment Flood Management Plan (CFMP) (2009)

2.3.4 The Isle of Wight CFMP[9] gives an overview of flood risk in the Isle of Wight catchment, and sets out the preferred plan for sustainable flood risk management. The document divides the Isle of Wight into six sub-areas, each allocated one of six flood risk management policies by taking into consideration the social, economic and environmental objectives of the region. The CFMP identifies that surface water flooding occurs in some urbanised areas of the Island due to the capacity of drains being exceeded. Linked to this, a Surface Water Management Plan for Ryde was produced in 2015[10].

[7] https://www.iow.gov.uk/azservices/documents/2821-IW-Local-Flood-Risk-Management-Strategy-2016.pdf

[8] http://www.coastalwight.gov.uk/smp/main.htm

[9] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/293850/Isle_of_Wight_Catchment_Flood_Management_Plan.pdf

[10] https://www.iow.gov.uk/azservices/documents/2821-Ryde-SWMP-Final-Report.pdf

3. Overview of flood risks

This section outlines the flood risks across the Island, covering fluvial, tidal, surface water, and groundwater risks.

3.1 Flood zones

3.1.1 Flood Zones are described throughout this SFRA and they refer to flood extent datasets held by the Environment Agency (EA). The published datasets are updated on a quarterly basis to capture any refinements as a result of detailed hydraulic modelling projects commissioned by the EA.

3.1.2 NPPG definitions of the Flood Zones are presented below:

- **Zone 1** / Low Probability
  Land having a less than 1 in 1,000 year annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3).
- **Zone 2** / Medium Probability
  Land having between a 1 in 100 and 1 in 1,000 year annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 year annual probability of sea flooding. (Land shown in light blue on the Flood Map).
- **Zone 3a** / High Probability
  Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map).
- **Zone 3b** / The Functional Floodplain
  This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3 on the Flood Map).

3.1.3 Figure A3 (in Appendix A) illustrates the extent of the Environment Agency Flood Zone 2 and 3 (accessed online via the Environment Agency Spatial Data Catalogue September 2018[11]).

3.1.4 Flood Zone 3 is typically subdivided into Zones 3a and 3b through use of detailed hydraulic modelling to inform flood extents. In the absence of detailed hydraulic models for the majority of the Island, it has not been possible to delineate areas of functional floodplain. Therefore, in line with NPPG this SFRA recommends that all fluvial Flood Zone 3 should be considered as Flood Zone 3b for the purposes of spatial planning, until demonstrated otherwise through site specific flood risk assessments. In line with NPPG (Table D.3 – Appendix D), this approach would exclude all but essential infrastructure (pending application of the Exception Test) and water compatible uses from Flood Zone 3. This designation should remain until that time a site specific FRA defines Flood Zones 3a and 3b in the affected sites.

3.1.5 The Flood Zones shown on the Environment Agency's Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding. Reference should therefore also be made to the Strategic Flood Risk Assessment when considering location and potential future flood risks to developments and land uses.

[11] https://environment.data.gov.uk/ds/catalogue/index.jsp#/catalogue

3.1.6 Flood Zones are determined without consideration of the presence of flood defences. The Flood Zones are intended to provide an appreciation of potential flood risks that exist, and indicate the areas which should be considered in the planning process. The EA maps do, however, show the areas that benefit from the presence of defences (ABDs) for a 1 in 100 year flood event from rivers, or a 1 in 200 year flood event from the sea. The only location on the Isle of Wight included within the EA ABD layer (as of September 2018) is an area of Seaview, discussed in Section 3.3.2.

Flood zonation for main rivers or ordinary watercourses with no modelling output

3.1.7 It is possible that a flood risk may be present for reaches of Main River and 'ordinary watercourses' but for which no flood modelling / risk mapping has been undertaken by the EA. In this instance, the flood risk from surface water maps provides some insight to the risk posed by such watercourses.

3.1.8 It would be prudent to use the 1000 year extent of the surface water maps along the courses of main rivers and ordinary watercourses for which no flood mapping exists, as a proxy for Flood Zone 3 in lieu of more detailed modelling or site-specific assessment.

3.2 Fluvial flooding

3.2.1 The Isle of Wight's largest river is the Eastern Yar and this discharges in to the Solent at Bembridge. A history of flooding is well documented along the lower reaches of this watercourse, the most recent significant events being during the autumn of 2000 and the winter of 2013/14.

3.2.2 Figure A1 (Appendix A) depicts the main rivers on the Isle of Wight and illustrates that the majority flow in a northerly direction. As a result of this drainage pattern, which is a function of the underlying geology, the main estuarine environments are on the northern shores of the Island, with the exception of the Eastern Yar Estuary.

3.2.3 The causes of flooding in the main catchments (shown in Figure 3-1 below) were assessed in the Isle of Wight CFMP, the findings of which are outlined in Table 3.1.

Figure 3-1 Main catchment sub-areas (Isle of Wight CFMP, 2009).

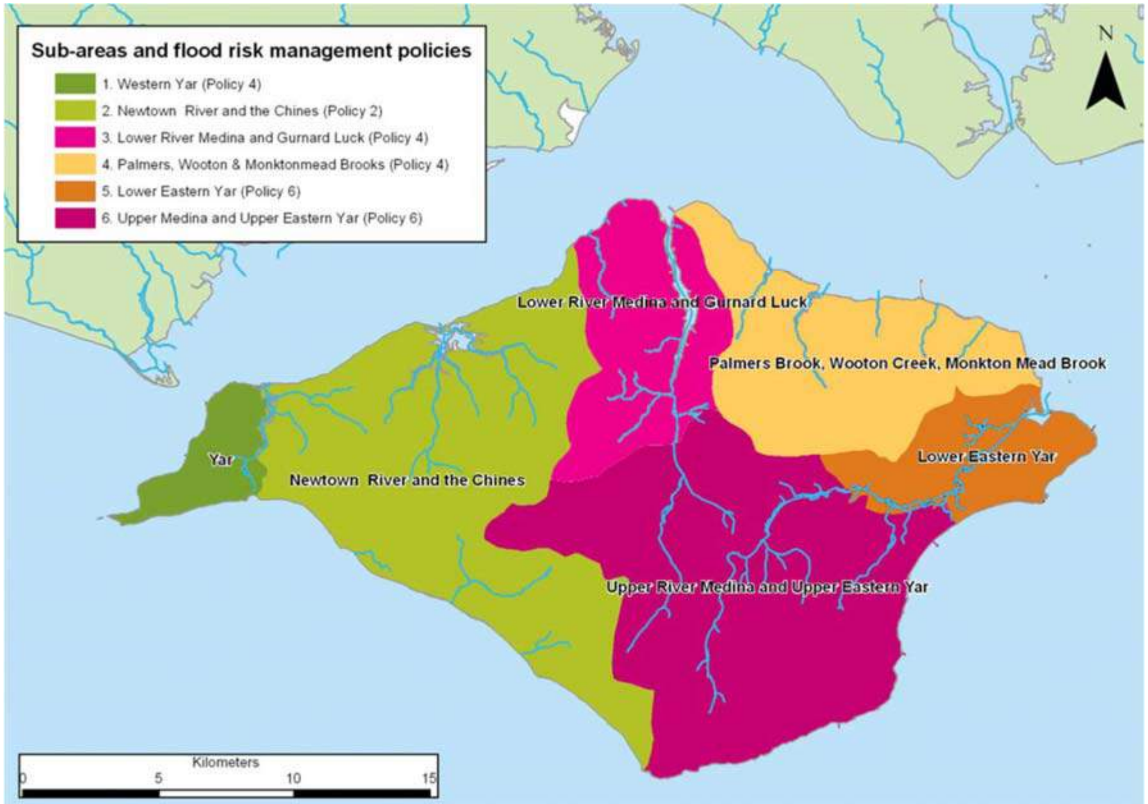


Table 3.1 Causes of flooding in each CFMP sub-area

Location	Key Issues of Flooding
Western Yar	• River flooding in Freshwater. • Restrictions in the channel in places can give rise to localised flash flooding. • Nearer the coast, river flooding may be affected by high tide levels.
Newtown River and The Chines	• Surface water flooding in some urban areas due to the capacity of drains being exceeded. • Nearer the coast, river flooding may be affected by high tide levels.
Lower River Medina and Gurnard Luck	• Both rivers are responsive to rainfall and affect by tide locking. • A number of low lying properties may make this area particularly sensitive to future sea level rise.
Palmers Brook, Wootton Creek and Monktonmead Brook	• Flood flows largely occur on the Monktonmead Brook. • Flooding in Ryde results from rainfall runoff over predominantly impermeable surfaces, combined with tide locked fluvial flows.
Lower Eastern Yar	• Overbank flooding of fluvial flows spill out into the floodplain. • Tidal locking fluvial flooding can occur. • Some incidents of surface water drainage flooding. • Very limited amount of groundwater flooding.
Upper Eastern Yar and Upper River Medina	• Flood flows result from either overbank flooding of fluvial flows, or surface water drainage flooding

Historic flooding

3.2.4 Figure A2 in Appendix A shows the EA's Historic Flood Map which combines the maximum extents of recorded flood events on the Island.

3.2.5 The CFMP Scoping Report for the Isle of Wight[12] noted that prior to 2000 there were a limited number of records of fluvial flooding on the Island. Events affecting more than 10 properties appear to be fairly low, with the exception of Ryde which has a long history of flooding dating back over 100 years.

3.2.6 Table 3.2 summarises the main flood incidents on the Isle of Wight during the 2000/2001 floods, as taken from the 'CFMP Scoping Report'.

Table 3.2 Flood risk incidents on the Isle of Wight based on 2000/2001 flooding event

Watercourse	Location	Cause	Properties Impacted	Previous recorded incidents
Monkton Mead Brook	Ryde	Pump failure / drainage	20, 74	1914, 1662, 1971, 1974, 1975, 1989, 1993, 1999
River Medina	Newport	Fluvial, drainage, tide locking	8	1934, 1951, 1960/61 (150 properties), 1993, 1999
Western Yar	Freshwater	Extreme rainfall, drainage	1	1954, 1968, 1999 (45 properties)
Eastern Yar	Small numbers at several locations	Drainage, fluvial	Less than 10 at 11 locations	1934, 1954, 1960

Autumn 2000 flood event

3.2.7 The main cause of flooding was the prolonged rainfall in the months of September to November 2000. This had the effect of raising and maintaining high groundwater and river water levels. Once saturated, the watercourses are considered 'flashy' in that they respond quickly to intense rainfall events with levels and flow rates rising and falling quickly. The result is short term flooding at times of peak rainfall. Other factors which the 'Isle of Wight Autumn 2000 Flood Investigation – Consultation Report' (January 2002) identified as being significant factors in the Autumn 2000 floods included:

- The geomorphology and geology resulting in high groundwater levels and high levels of ground saturation.
- Inappropriate historic development in the floodplains.
- Insufficient drainage capacity and maintenance causing water to back up and flood property.
- Highway drains being blocked or where flows were in excess of drainage capacity;
- Tide locking of sewers and watercourses; and
- A history of changes in water resource management and budgetary constraints.

3.2.8 The Consultation report included an assessment of the return period for the October/November flooding of 2000 as being in the order of 1 in 20 years.

[12] Environment Agency, Managing Flood Risk – Isle of Wight Catchment Flood Management Plan Scoping Report. (February 2007)

3.2.9 The information below, on individual settlements, has been obtained from the 'Flood Event – Final Report 24th December to 26th December 1999' (September 2000). The number of properties flooded has been derived from questionnaires returned at the time of the event.

- *"Gurnard*

  Gurnard Luck became tide locked and the increased river Levels caused five properties to be flooded. In Newport four properties were flooded from a main river and one was flooded by an ordinary watercourse. The tidal high water coincided with the rising river levels and when the two levels matched the tidal flaps closed and thus tide-locked the river. This caused the river levels to rapidly rise a further 300mm. Marsh Road was reported to have been covered by about 400mm of water.

- *Cowes*

  Cowes experienced some tidal flooding during December 1999, one property was reported as being flooded inside and a further six were flooded outside. Tidal flooding was abated by a sand bag wall constructed by Environment Agency contractors and by a change in the wind direction which reduced wave action.

- *Newport*

  An engineering team had been deployed since early in the morning of the 24th December to ensure that the three trash screens on the Lukely Brook were regularly cleared during the day. Lukely Brook responded rapidly to the heavy rainfall and levels soon rose to a dangerous level for workmen to clear the trash screens. Consequently, four properties were flooded from the main river and one was flooded from an ordinary watercourse.

- *Ryde*

  Ryde was identified as being the settlement which sustained the most severe damage during the 2000 floods. Investigations on Monktonmead Brook have previously been carried out as there has been a history of regular flooding problems. Many of the properties were flooded from sewers being overwhelmed and because high water levels in the brook prevented free discharge of storm drains. The high river flow coincided with the high tide locking the Brook. One of the pumps which are designed to help alleviate the tide locking suffered a brief failure but was quickly returned to operation. Around seventy houses were flooded by the high groundwater and combined sewers overflowing. Basement flooding was a key issue.

- *Seaview*

  Flooding started around midnight on 24th December and lasted for around three to four days. The flooding was the product of two factors: high tide waters flooding over the sea wall; and flooding of the salt lake to the rear of the town due to poor drainage."

Winter 2013-14 event

3.2.10 Recorded rainfall in January 2014 at Knighton and Carisbrooke rain gauges was the highest on their respective records. January's rainfall at Knighton was 213mm with the annual average being 814mm, equating to a quarter of a year's rainfall in a month. It is reported in the LFRMS that "*approximately 50 properties flooded across the Island, although it is likely that this number is actually higher*".

Impact of tide locking on river discharge

3.2.11 The tide can have a direct impact on fluvial flooding. If high fluvial discharges coincide with mean high water in a river's estuary then discharge from the river is inhibited. Effectively, a high tide raises the downstream boundary of the river and when this occurs the fluvial waters are forced to back up and, depending on the discharge, spill out over the floodplain. The problem of tide locking river discharge is one that was frequently cited in the CFMP Scoping Study (February 2007) as being a key flooding concern. The tide locking of Monktonmead Brook in Ryde caused some of the worst flooding on the Island during the 2000 flooding event.

Residual risk

3.2.12 The CFMP Scoping Report identifies the greatest part of the Environment Agency's major flood defence work on the Island is on the tidal reaches of the rivers. The CFMP highlights the following fluvial alleviation schemes:

- The Schoolgreen area of Freshwater on the Western Yar;
- A 4 km stretch of the River Medina through Newport;
- Lukely Brook between Towngate Bridge and Westminster Mill;
- A flood storage area in the centre of Newport; and
- The tributaries of the Lukely Brook, Gunville and Merstone Streams, including lined sections of channel, velocity weirs and culverts.

3.2.13 In addition to the flooding in 2000, the Monktonmead Brook has contributed to extensive flooding in Ryde in both the 2010 and 2013 events. In response to the flooding, the EA are implementing a flood defence scheme designed to restore the standard of protection in Ryde to the 1 in 100 year event[13]. The scheme comprises a new outfall pipe from the sea wall in front of the existing pump station into Ryde marina, and the construction of a flood wall around the Simeon recreation ground, to create a flood storage area. The scheme will better protect over 300 properties from flooding.

3.3 Tidal flooding

Meteorologically induced extreme sea levels

3.3.1 Storm surges arise from low atmospheric pressure systems causing the sea surface to rise. If meteorological conditions coincide with high astronomic tides, then more extreme sea levels may be observed.

Residual risk

3.3.2 Some isolated areas of Seaview coincide with areas benefitting from flood defences as shown on the EA ABD mapping, indicating a defence that offers protection from the 1 in 200 year tidal event. These areas would therefore be considered at residual risk of flooding from the failure of these defences. Elsewhere, while there are flood defences, these don't coincide with ABDs because the minimum standard of protection is not met. Nonetheless any area behind a flood defence structure is in a zone of residual risk in the event of failure.

[13] https://www.rydetowncouncil.org.uk/wp-content/uploads/2018/03/Monktonmead-Brook-Outfall-Improvement-Scheme.pdf

3.3.3 When preparing a FRA in coastal areas the role of flood defences and the impact of their failure should be included. Flood defence locations can be obtained as part of a data request to the Environment Agency External Relations team.

3.4 Groundwater flooding

3.4.1 Groundwater flooding on the Isle of Wight is not considered by the Environment Agency as a significant issue and for the purposes of this SFRA, a summary of the available information has been agreed to be all that is required.

3.4.2 The 2002 Consultation Report into the Autumn 2000 floods states that in some cases it may not so much be groundwater causing the flooding, as impermeable bedrock restricting the infiltration of rain and thus leading to high rates of surface run-off. The following were identified in the Consultation Report as being the areas of geological formations noted on the Island as being flood affected. Figure A5 (Appendix A) broadly represents the major geological formations on the Island.

3.4.3 **Wealden Beds**

The Wealden beds are composed of two series, Marls and Shales. Both of which have very low permeability. The low permeability is a function of the rock being formed from fine particles of slit and mud. As such these beds present a barrier to the passage of groundwater, fractures within the lithology represent the only routes for the percolation of groundwater. The Wealden beds can be found in the Atherfield and Sandown areas.

3.4.4 **Lower Greensand**

The Lower Greensand beds are composed of a series of sands and clay strata of varying thicknesses and permeability. Owing to these variations and discontinuities in the underlying rock, the formation's groundwater response to rainfall events is characteristically non uniform. The Consultation report concluded that it is not possible to predict groundwater levels for any location without further investigation. The Carstone and Sandrock beds are known aquifer bearing rocks. The Carstone formations can be found in the Allens, Redhill Lane and Sandford areas and the Sandrock beds are found at Newport, Whitwell and Stonebrook.

3.4.5 **Upper Greensand with Chert layers**

The permeability of this structure is dependent on the level of cementation between the composite grains. The formation is permeable and is noted as being one of the most important aquifer bearing rocks on the Island as the sandstone is underlain with thick blue Gault clay which acts as an impermeable barrier and creates a spring line. The Upper greensand has been identified in the Niton, Shorwell and Whitwell areas of the Island.

3.4.6 **Osborne and Headon Beds**

The Osborne and Headon Beds are a series of sands, silts, clays and marls with some limestone bands. The presence of low permeability clays and marls reduce the permeability of the sands within which they are inter-bedded. Groundwater has been known to rise to the surface at the old railway works in Newport. In order to ascertain the proportion of flooding attributable to groundwater, the Consultation report recommends the need for more detailed site specific information. Freshwater and Brading have been listed by the Consultation report as areas on the Island where the Osborne and Headon beds are located.

3.4.7 **Bembridge Marls**

The Bembridge Marls, which are present at Gurnard, Bembridge, Seaview and Wootton Bridge, are impermeable lagoon and freshwater blue and green clays.

3.4.8 **Hamstead beds**

Across a large part of the north of the Island lie the Hamstead Beds, they are composed of clays, loams, sands and shales. The permeability is thus highly variable, with the sand deposits being the most water bearing of the composite units. More detailed information at a site specific level is said to be necessary by the Consultation report in order to determine the proportion of the flooding attributed to groundwater.

3.5 Surface water flooding

3.5.1 Surface water flooding is the term applied to flooding when intense rainfall overwhelms the ability of the land to infiltrate water, or in urban areas for the sewers and road drains to drain the water away, resulting in surface water runoff and consequent flooding. It is a particular problem in urban areas where the excess water will often travel along streets and paths, between and through buildings and across open space. It can result in indiscriminate flooding to properties when not controlled. The high profile flooding across the UK in the summer of 2007 was largely attributed to excess runoff where the capacity of the drains was exceeded by intense summer rain storms and led to the Government commissioning the independent Pitt Review in 2008**.**

3.5.2 The 2010 SFRA assessed each RDA through a pluvial modelling exercise. Since the production of the 2010 SFRA, the EA have released the Risk of Flooding from Surface Water (RoFSW). This SFRA presents the surface water flood map using the data available on the EA mapping services, as shown in Figure A6 in Appendix A.

3.5.3 Detailed surface water assessment was undertaken in Ryde through the Surface Water Management Plan (2016). In this study, an InfoWorks ICM model was created to assess the areas at risk of flooding in Ryde, and identify any potential mitigation options.

3.5.4 The Environment Agency has not identified any Critical Drainage Areas (CDAs) on the Isle of Wight. CDAs are identified where there is a complex interaction of surface and sewer water flooding. Had any CDAs been identified on the Island, any development within these areas, including in Flood Zone 1, would require a FRA.

4. Climate change

This section details the approach used to assess the impacts of fluvial and tidal climate change at a strategic level, to highlight locations where there is potential sensitivity to future changes.

4.1 Introduction

4.1.1 Climate change is frequently cited as being one of the most significant threats to the long term sustainability of our environment. It is essential that the likely impact of climate change on the extent of the future Flood Zones is considered if development is to be sustainable over the long term. The Isle of Wight Council is unique in the UK in being the only LPA, to be bordered by the sea on all sides, thus making the issue of sea level rise one of critical concern.

4.1.2 The current extents of Flood Zones 2 and 3 are critical to the site allocation process, but a view as to how these extents may change in the future is of importance. NPPF notes that the implications of climate change could mean that a site currently located within a lower risk zone could be reclassified as lying within a higher risk zone at some point in the future.

4.2 Fluvial domain

4.2.1 It is the intention of this assessment to determine how sensitive the fluvial domain on the Isle of Wight is to increased river flows. This involved an uncomplicated Island wide approach that utilised all the available data.

Assessment approach

4.2.2 Climate change is predicted to increase the magnitude of the 1 in 100 year flood. An assessment approach requiring no further modelling was adopted in this SFRA to identify areas of floodplain potentially sensitive to climate change. This was achieved through using the Flood Zone 2 extent as a proxy for Flood Zone 3 plus climate change. This approach is solely intended to provide an indication of whether a location may be sensitive to climate change, and does not replace the need for the detailed consideration of climate change in a FRA.

4.2.3 If there is little or no difference between Flood Zones 2 and 3, then the flooding extent in that area of floodplain can be considered insensitive to an increase in fluvial flow and thus insensitive to the impacts of climate change. Floodplain topography controls how sensitive the flood extent is to an increase in fluvial flow. Along reaches where the valley floor is narrow and the sides are steep, there will be little lateral expansion of the flood extent. The depth and velocity will increase more significantly in areas where the extent increases the least. Accordingly, areas where the valley floor is wide and flat and not bounded by steep valley sides, the flood extents are large and expand laterally more significantly as a consequence of increased in fluvial flows.

4.2.4 To assess the sensitivity of the Island's floodplains to increased fluvial flows, the smaller extent of Flood Zone 3 was clipped from the larger extent of Flood Zone 2 within a GIS software package. This produced a dataset which represented all the locations where the extent of Flood Zone 2 is larger than the extent flood Zone 3. Tiny fragments of this dataset were removed to leave only areas considered to be significant. The value of 250m^2 was used as the threshold of significance. This is the threshold used by the Environment Agency when editing the Flood Map. Areas of flooding less than 250m² which are not connected to the main body of flooding are deleted from the Flood Map.

Sensitivity to climate change in the fluvial domain

4.2.5 Areas of fluvial floodplain identified as being potentially sensitive to the impacts of climate change are illustrated in Figure A7 in Appendix A. This figure shows that, for the most part, the extents of Flood Zone 2 and 3 are very similar as there are not many large areas of black on the map. This is due to the fact that the majority of the Island's rivers flow in well-defined floodplains.

4.2.6 Two locations where there are significant differences between the extent of Flood Zone 2 and 3 have been highlighted. These are a tributary of the Clamerkin Brook near Porchfield, and Monkton Mead Brook through Ryde.

- **Clamerkin Brook tributary - Porchfield**: A large difference in extents between Flood Zones 2 and 3 can be seen at the upstream most section of the tributary to the Clamerkin Brook. This is likely because this is the upstream boundary of the model, and the results may not necessarily be an accurate reflection of the extents here.
- **Monktonmead Brook – Ryde**: Flood Zone 2 appears to be significantly larger than Flood Zone 3. It is thought that some of this difference may be attributed to different modelling methods used to produce the two Flood Zone extents. Flood Zone 3 in Ryde appears to be the product of the detailed Monktonmead model whereas Flood Zone 2 appears to be the product of a more generalised modelling.

4.2.7 This high level assessment intended to establish whether the potential impacts were extensive or restricted to a few locations. It is found that Island wide fluvial climate change modelling is not necessary to inform the SFRA. It can be concluded that small areas of the Island's fluvial floodplains contain small areas where climate change may have an impact on the extent of the Flood Zones. The 'Areas of Fluvial Floodplain Potentially Sensitive to Climate Change' dataset (see Figure A7 – Appendix A) should be used as an indication of where the impact of climate change on the fluvial Flood Zones should be considered in more detail as part of site specific FRA's. Any development proposals for sites which fall within this dataset must account for climate change allowances in their accompanying FRAs, to be in line with advice offered in NPPF.

4.3 Coastal domain

Assessment approach

4.3.1 An assessment into the potential tidal flooding impacts of sea level rise was undertaken as part of the 2010 update to the SFRA. For that assessment, the extreme sea levels for the 1 in 200 and 1 in 1000 AEP tidal events were added to the predicted sea level rise for the 2045, 2080 and 2115 epochs (as per PPS25, at the time). This provides an indication for the future 1 in 200 and 1 in 1000 AEP still water levels.

4.3.2 The assessment was based upon an ArcGIS shapefile supplied by the Environment Agency on in September 2009. Environment Agency LiDAR topographic data formed the ground model in the mapping exercise, with a resolution of five metres. Table 4 in the Technical Guidance to the NPPF[14] was used to determine the rate of sea level rise, the South East figures were used for the purposes of this exercise. Figure E1 in Appendix E provides an illustration of the coastal cells and it details the predicted sea-levels for the mapped epochs.

[14] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/6000/2115548.pdf

4.3.3 The mapping includes the 2010, 2045, 2080 and 2115 epochs. The base 1990 sea levels issued by the Environment Agency are to the nearest 0.1m. With the intention of not adding false accuracy, the climate change predictions have been rounded to the nearest 0.1m. Appendix E provides Figure E1 which displays a map of the Island and the coastal cells along with the associated predicted sea level rise values.

4.3.4 The extreme sea levels used in the modelling were calculated from adding the incremental sea-level rise figures specified by the Technical Guidance to the NPPF (Table 4)[15] for the South East, to the base 1990 extreme levels issued by the Environment Agency (September 2009). These extreme sea levels are derived from probabilistic storm surge heights, but do not account for wind or wave action.

4.3.5 The calculated still water levels for the 1 in 200 and the 1 in 1000 events were projected across the Island ground model, to produce Figures A8 and A9 respectively in Appendix A.

Sensitivity to climate change in the tidal domain

4.3.6 There are no areas covered by the tidal climate change assessment which exhibited large predicted increases in spatial extent. Although the extent of flooding may not always increase significantly, the depth of flooding will increase.

4.3.7 The tidal climate change flood risk zones should be used to provide an indication of the likely possible extent of future flood zones, however they are not definitive. The outlines are considered to be sufficient to inform the Council of where the long term sustainability of developments may potentially be compromised. Moreover, these datasets can be used to draw the Council's attention to where site specific FRAs should include mitigation measures to demonstrate how the risk of flooding will not increase as a result of the impacts of climate change.

UKCP18

4.3.8 The UK Climate Projections 2018 (UKCP18) delivers a major upgrade on UKCP09 to the range of UK climate projection tools designed to assist with planning and taking into account the potential impacts of climate change.

4.3.9 UKCP18 will supersede UKCP09 and will include updated marine and coastal projections (sea level rise and storm surge), and a 2.2km resolution model providing sub-daily projections of intense rainfall events.

4.3.10 The projections and model outputs are unlikely to be available until mid-2019. It is therefore not possible to comment on the specifics of UKCP18 at this stage, but important to note that the implications should be assessed when guidance is provided nationally.

[15] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/6000/2115548.pdf

5. Assessing the impacts of wind action and wave spray

This section of the SFRA aims to assess the potential risks to the areas which fall outside the zones of tidal inundation, where there is a potential risk associated with the impacts of wave energy and wave spray.

5.1 Rationale for assessment

5.1.1 Wave action relates to both the erosive capacity of the waves themselves but also spray action and its effects in damaging coastal infrastructure. This can cause a problem in more exposed areas, areas of high energy wave environments and/or during winter months when stronger winds create a more aggressive wave environment around the coastline.

5.1.2 This assessment has informed the creation of a zone around the Island which highlights the area which may be at risk of the potentially damaging influences of wind and wave action. The available information has enabled this buffer zone to be classified into the High, Medium and Low Risk. An Island wide map is provided in Figure A10 in Appendix A.

5.1.3 A review of the potential impact of wind and wave action only has value, in an SFRA context, if applicable policy recommendations can be produced by the assessment. In coastal areas predicted to be at risk of tidal inundation, finished floor levels, ground floor uses and the requirement for safe internal escape routes are governed by the predicted extreme tide levels. Wave action is more a function of energy and spray than flood depth and flood extents. In this instance, the assessment and therefore the Development management guidance produced will relate to building resilience against the impact of wave action and wave spray impact.

5.2 Baseline assessment

Coastal vulnerability

5.2.1 Evaluating vulnerability of the coastline to wave action is complex and there are many environmental factors that need to be considered when considering the vulnerability of the Isle of Wight coast. The factors reviewed in this assessment are exposure, tidal heights and coastal geomorphology and wind action and spray, these are addressed in turn below.

Exposure

5.2.2 The key criterion in determining vulnerability to wave impact is exposure. It is possible to broadly identify coastal environments based upon two different levels of wave energy on the basis of prevailing wind speeds, fetch and coastal configuration[16]. The amount of energy available in wind driven waves depends upon the velocity, duration and fetch of the wind. The highest waves are produced by strong winds blowing in the same direction and over a long distance. Those areas of the coast that are more exposed to wind energy and have a longer fetch will be most at risk to higher energy wave environments, while other areas will be naturally more sheltered by surrounding land masses. Exposure is also a function of the predominant wind and wave direction.

[16] Summerfield, M.A. 1991. Global Geomorphology. Prentice Hall.

5.2.3 Vulnerability may also be determined by the coastal landform, in general, headlands and promontories are more exposed and therefore more vulnerable while estuaries inlets and bays are more sheltered and less vulnerable.

5.2.4 In addition, some areas of the coast may have natural or man-made defences in place whereas others may be left undefended and are therefore more at risk. Areas with wide beaches or gravel barriers may be naturally well protected while in other areas coastal defence measures provide artificial protection.

Tidal heights and coastal topography

5.2.5 It is likely that exposed areas of coast will be subject to the highest waves as there is a greater distance for wind generated waves to propagate, as described above. However the likelihood of exposed areas suffering extreme wave impacts and spray is also a function of the tidal regime and topography of the area. If winds are strong, waves may become unusually large and sea spray may travel many metres inland and in some cases can overtop cliffs. However generally it is in lower lying areas, and areas with high tidal levels in which storm winds and waves present the greatest hazard. If land is low lying over a large distance inland this can also increase risk as larger areas are more exposed, conversely if lower lying areas are backed by steeply rising land or cliffs this can offer some protection to the land behind. Storm conditions can often create very low pressure, during which tidal levels can become even higher creating a 'storm surge'. As well as flood risks, high tidal levels plus increased wave heights maximise the likelihood of wave and spray impacts at the coast and further inland.

Wind action and spray

5.2.6 Storm processes rarely act separately, wind, waves and rising water all interact during storm events and it is the combination of these effects that can make sea or coastal storms so damaging. Rising tidal levels during storm events causes issues of overtopping and flood inundation while direct wave impacts on the coast can be incredibly damaging causing erosion of coastal areas and infrastructure failure. However the effects of storm winds at the coast can also be very damaging to both the urban and environmental fabric. Storm winds can cause direct damage to buildings and infrastructure but in combination 'sand blasting' of buildings can occur when impacted with spray heavily laden with sand and finer particles. During extreme coastal storms heavier particles including gravels and even boulders can become airborne, which can be extremely dangerous and costly to coastal infrastructure. Even during calmer weather, strong coastal winds are capable of transporting damaging salt spray inland.

Coastal characterisation

5.2.7 The following section describes the baseline conditions for the Isle of Wight Coastline. Available information has been used to provide an assessment of the coastline in terms of topography, characterisation and condition i.e. exposure, erosion/accretion and sediment transport, an assessment of the wave boundary conditions including wave heights, direction and storm waves and an overview of coastal defence measures in place. Understanding the current coastal environment provides an indication of the levels of exposure which can then be used alongside tidal height predictions to create a vulnerability profile for the Isle of Wight.

5.2.8 Information used in this assessment includes:

- LiDAR topographical data (Environment Agency);
- Geological maps of the Isle of Wight (British Geological Survey)

- Assessment of shoreline dynamics for the Isle of Wight (Isle of Wight SMP);
- Southeast Strategic Regional Coastal Monitoring Programme Annual Report 2009 (Channel Coastal Observatory); and
- Average and storm wave heights for boundary areas (Channel Coastal Observatory).

5.2.9 The following sections describe the general coastal characteristics around the Isle of Wight in terms of exposure, stability, erosion and accretion, the dominating hydrodynamic regime and sediment transport. The summary presented uses information provided within the report 'Assessment of Shoreline Dynamics for the Isle of Wight' produced by the Isle of Wight Centre for the Coastal Environment and which forms Appendix C of the new SMP document.

General coastal characteristics

5.2.10 The Isle of Wight coastline is extremely varied and dynamic over a relatively small area. Marine erosion is in action around the coast to produce an almost continuous cliffline with a varied morphology resulting from the varied geology present. The solid geology and structure of the Isle of Wight is dominated by an east-west chalk ridge which cuts through the centre of the Island and is exposed at either end to form headlands at the Needles in the west and Culver Cliff in the east. To the north of this ridge, the relatively sheltered coastline of the Solent is characterised by low lying land and estuaries. While to the south the coastline is dominated by high sea cliffs and is more exposed to wave and weathering impacts and associated erosion. A prominent feature of the south coast is the Undercliff, an ancient coastal landslide complex measuring approximately 12 km in length and extending up to 500 m inland and 2 km seawards.

5.2.11 In terms of erosion the south coast is particularly vulnerable, due to a combination of exposure to the large storm events that cross the Atlantic and the formation of softer Wealden rocks that are present across the south west coast of the Island. The exposed high energy southern coast also presents greater potential for sediment transport, compared to those areas along the sheltered environments of the north and north east which are characterised by five estuary environments. However strong tidal currents are generated in the western Solent and these contribute to sediment mobility in certain areas.

5.2.12 The offshore and nearshore zones of the Island are characterised by a thin layer of sand and gravel that forms gravel banks in some locations and provide a source of onshore gravel during storm conditions. Sediment transport in the nearshore zone is complex around the Island as sediment movement is interrupted by estuaries, headlands and offshore features. Around the coast, seabed sands and gravels are highly mobile during peak flows with a general eastward transport from the predominantly south, south westerly winds. At locations where this transport is interrupted for example at Thorness Bay and Hurst Narrows, sand and shingle banks have formed.

5.2.13 Much of the coastline of the Isle of Wight is undefended in engineering terms, however a number of sections of the coast around key developed areas have been heavily modified by hard coastal defences. Areas include Cowes, Ryde and Bembridge Harbour, Ventor, Sandown Bay and in the extreme northwest at Totland and Yarmouth. At these locations defences are reported to be in fair or good condition.

Coastal condition – exposure, erosion and accretion

Northeast to east – Old Castle Point to Culver Cliff

5.2.14 The northeast Isle of Wight is mostly low lying or of low relief. Erosion occurs along the majority of the coast resulting in the development of varied cliff forms and includes inlets of Bembridge

Harbour and Wootton Creek. Waves to the east of Ryde are generated in Hayling Bay and the English Channel and therefore wave energies are moderate approaching predominantly from the east or southeast. In contrast to the west of Ryde the area is more sheltered and prevailing winds are generated in Southampton Water and the East Solent and are fetch limited. Wave conditions in this area are therefore generally low energy, dominated from a northwest direction. In general tidal current speeds in the east are slower than in the west and the area is dominated by coarse sediments although most are in-channel rather than shoreline deposits. The foreshore at Ryde is dominated by increasingly sandy sediments and at 'Ryde Sands' a major accumulation of sand deposits have developed.

East to south – Culver Cliff to St Catherine's Point

5.2.15 The coast between Culver Cliff and Dunnose on the south east coast has developed through marine erosion of the predominantly soft clays and sands of the Wealden and Lower Cretaceous Groups. The east facing coast is relatively protected from waves generated by dominant westerly winds, but it is fully exposed to east and south easterly winds which have a fetch distance of just over 200 km and over which large waves can propagate.

5.2.16 Almost the entire length of this coastline is characterised by active cliff development, with local beaches of varying width associated with numerous groyne installations. Substantial seawalls and promenades at Shanklin and Sandown serve to protect the cliff line from direct wave attack and between Yaverland and Shanklin Chine the coast is fully protected by a variety of structures including seawalls, revetments and groyne fields. Between Shanklin Chine and Dunnose there are few defences but this area of coast is not believed to have changed in recent decades.

5.2.17 The undercliff coastal frontage is an exceptionally dynamic and unique section of coast exposed to a maximum fetch of 150 km defined by the width of the English Channel. Although coastal defences protect large sections of the developed coastline of the Undercliff, the undefended areas are subject to high energy wave attack resulting from storm events which has led to significant loss in beach material over a relatively short timeframe. Storm surges that propagate in the English Channel typically move through from west to east reaching a maximum near the Isle of Wight and can add over 1 m to predicted sea level in the area. Tidal currents are often strong in this area, particularly at St Catherine's Point. Sediments of the Undercliff coastline consist almost entirely of gravel and sandy gravel and between Ventor and St Catherine's Point, several well defined pocket beaches consisting of 'pea size' gravel (D50 10mm) have developed.

South to west – St Catherine's Point to The Needles

5.2.18 The frontage between St Catherine's Point and The Needles occupies one of the most exposed locations on the south coast of England with long fetches in excess of 4000 km, extending directly into the north east Atlantic and the English Channel. It is exposed to swell wave (Ocean wave) activity as well as to energetic locally generated wind waves. Numerical modeling undertaken by HR Wallingford indicated that maximum wave heights for a 1 in 1 year event is up to 5m for the coastline between Freshwater Bay and the Needles. Wave exposure and the steepness of the nearshore profile are greatest towards the south east so that Chale Bay experiences the most energetic shoreline wave environment. Tidal currents are generally weak at the shoreline, but increase in velocity as they are forced around the headland of the Needles and Rocken End. Generally beaches consist of gravel backshores and sandy foreshores and progressively steepen between Rocken end and Freshwater Bay. Along the south west coast a concrete sea walls defend the development of Freshwater while the remainder of the coast consists of agricultural land with isolated small settlements and is unprotected.

West to north – The Needles to Old Castle Point

5.2.19 From the Needles to Cliff end, the area comprises a combination of relatively resistant rock material with spatially varied exposure to waves and currents, resulting in the formation of a predominantly eroding coastline characterised by well developed cliffs and landslides. The Needles headland provides shelter to this area from waves but despite this it remains exposed to dominant waves approaching from the northwest, west and south west. HR Wallingford Predictions (1999) provide potential maximum significant wave heights of up to 2.36 m for a 1 in 50 year return period south of Fort Albert. The rapid erosion of cliffs provides large quantities of fine sediments that are easily transported and at this location a net movement of sediment transport offshore is inferred.

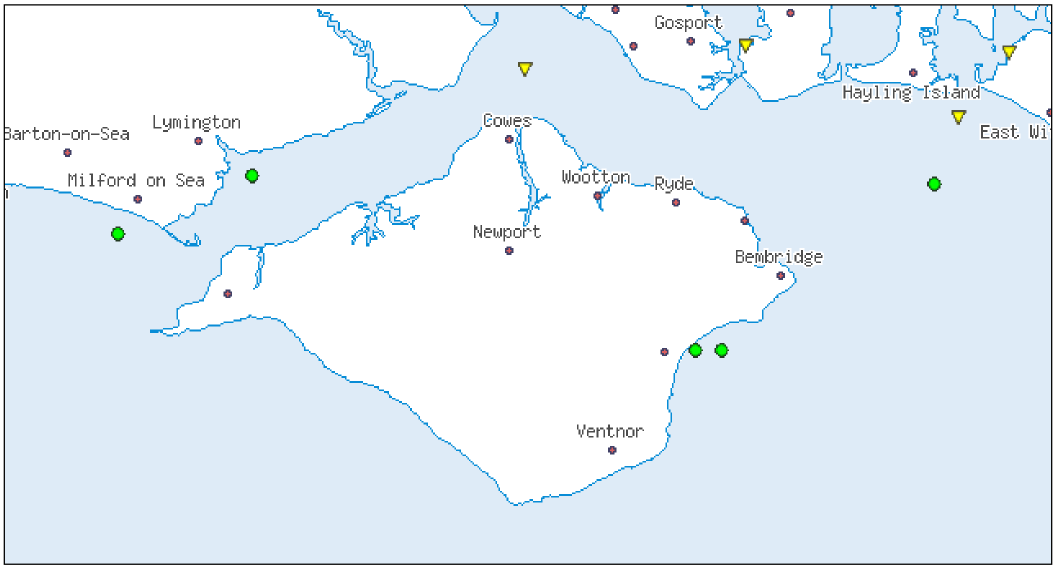
5.2.20 Further north between Fort Albert and Cowes the coast is sheltered from the open sea and incident waves generated in the West Solent are Fetch limited and generally less than 1 m in height. The coastal topography of this area is undulating with erosion of the soft mud strata forming a series of high points along the coast at Bouldner Point, Burnt Wood and Gurnard Cliff. Tidal currents and wave action continue to erode the base of these cliffs and transport fine material off and alongshore, promoting further instability. The shoreline has a complex and varied sediment transport regime due to a combination of the coastal configuration and hydraulic regime in operation. Transport of sediment is separated by headlands and estuaries with weak littoral drift in a north eastward direction, that is intercepted at inlets and estuaries which promote storage of sediments.

5.2.21 Most of the coastline across this area is natural but there has been some localised shoreline stabilisation by seawalls at Yarmouth and Cowes. In addition limited beach nourishment has occurred at several locations to avoid the undermining of coastal protection structures in place.

Wave boundary conditions

5.2.22 Figure 5-1 below shows the location of waverider buoys and wave gauges in place around the Isle of Wight. These are deployed and managed by the channel coastal observatory and provide boundary conditions for the Isle of Wight in terms of wave climate. Wave buoys at Sandown Bay provide an indication of wave conditions for the south east of the Isle, the wave gauge at Hayling Island provides boundary conditions for the north east and those at Lymington and Milford provide indications of wave conditions for the northwest and west. Although only boundary conditions these present the best wave data available and can be used to provide an indication of the wave regime around the coast.

Figure 5-1 Location of wave gauges and wave buoys (Channel Coastal Observatory)



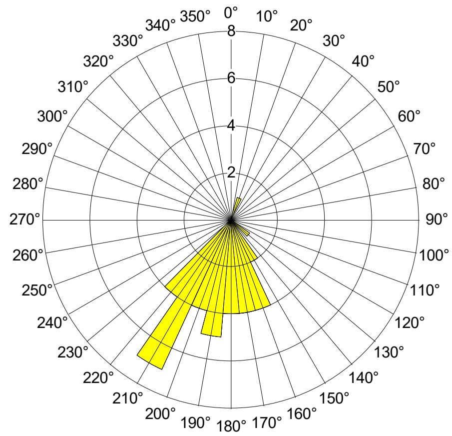
5.2.23 Table 5.1 below presents a summary of wave heights for the each of wave buoys and gauges around the Isle of Wight. Both monthly and average heights are demonstrated. It is clear that those wave approaching from the west and north east are higher than those approaching from the north and the south east. In particular the gauge at Lymington within the sheltered area of the Solent demonstrates particularly low wave heights throughout the year. It would be useful to present wave data from the south west as this area of the coast is most exposed, but unfortunately no buoys are currently positioned at this location. In general wave heights are increased during autumn and winter months as opposed to spring and summer which is to be expected based upon prevailing weather conditions.s

Table 5.1 Boundary condition wave heights

Location (10 m water)	**Average wave height (m)**												
	Jan	Feb	Mar	Apr	Mar	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Av
Hayling Island	1.19	0.78	0.90	0.59	0.42	0.49	0.61	0.75	0.68	0.76	0.69	0.68	0.71
Sandown Bay	0.81	0.60	0.56	0.47	0.41	0.32	0.43	0.50	0.55	0.52	0.51	0.55	0.52
Sandown Pier	0.54	0.43	0.38	0.37	0.35	0.28	0.31	0.33	0.39	0.37	0.40	0.43	0.38
Lymington	0.23	0.16	0.17	0.15	0.12	0.13	0.15	0.21	0.15	0.16	0.14	0.13	0.16
Milford	1.13	0.65	0.90	0.52	0.28	0.54	0.67	0.86	0.60	0.78	0.63	0.53	0.67

5.2.24 The wind rose below (Figure 5.2) presents a summary of the predominant wind and wave direction for the Isle of Wight. The directions used are monthly averages for each of the directional waverider buoys at Hayling Island, Sandown Bay and Milford, the wave gauges at Sandown Pier and Lymington do not record directional data and these are therefore not included.

Figure 5-2 Boundary condition wave directions



5.2.25 The wind rose demonstrates that in general prevailing or dominant wind and wave direction across the year is from the south west with a moderate frequency from the south east. It is therefore the south west of the coast and to a lesser extent the south east that is considered to be most exposed to wave impacts.

Table 5.2 below presents storm wave data for those storms recorded during 2008. The highest and most frequent storm waves were experienced at the Hayling Island buoy with wave heights exceeding 3 m in 3 events. Sandown Bay also demonstrates waves of over 3 m during two storm events as does the buoy at Milford. Again it is the wave gauge at Lymington that demonstrates the fewest storms with the lowest wave heights (0.91 m) indicating the sheltered nature of the coast at this location. In addition to the data presented below, as stated in section 1.4.2 above, predictive modelling undertaken by HR Wallingford provides maximum storm wave heights of 5 m for a 1 in 1 year event in the south west of the Island and this should be considered when taking into account wave exposure conditions of the coast.

Table 5.2 Highest storm events in 2008

Location (10 m water)	Highest storm events in 2008		
	Time	Wave height m)	Direction (o)
Hayling Island			
10-Mar-2008	08.00	3.79	183
13 -Dec-2008	10.00	3.64	169
04-Dec-2008	09.00	3.02	187
15-Jan-2008	11.30	2.92	191
03 -Feb-2008	23.00	2.90	159
Sandown Bay			
10-Mar-2008	11.30	3.63	173
13-Dec-2008	06.00	3.36	172
04-Feb-2008	01.00	2.75	153
04-Dec-2008	09.00	2.53	179
Sandown Pier			
13-Dec-2008	09.00	2.01	-
03-Feb-2008	21.20	1.75	-
10-Mar-2008	08.00	1.62	-
Lymington			
10-Mar-2008	11.40	0.91	-
Milford			
10-Mar-2008	20.00	3.42	-
31-Jan-2008	12.00	3.27	219

5.3 Delineation of a potential wave exposure risk buffer zone

5.3.1 The following section describes the methodology used to assess the coastal vulnerability of the Isle of Wight and create a buffer zone map to inform future development.

Classification of exposure risk

5.3.2 Using the information discussed in the previous sections, an assessment of exposure has been undertaken and is presented in Table 5.3. This high level assessment is based on a conservative approach which makes a judgement on the level of exposure that is based upon both exposure to wave impact and wave height and exposure in terms of defences both man made (groynes, seawalls) and natural (beaches, sediment transport, cliff erosion). The risk classifications presented in Figure A10 in Appendix A are based upon the assessment results presented in Table 5.3. A qualitative classification has been undertaken of the predominant wave condition and the exposure of the coast, either 'high', 'medium' or 'low'. These classifications were then combined to form a single risk classification for a given length of the coastline.

Table 5.3 Summary of coastal condition and exposure assessment

Location	Predominant wave condition	Score	Exposure	Score	Risk Classification
North to east		**H/M/L**		**H/M/L**	**H/M/L**
Old castle point to Ryde	Generally low energy fetch limited from north west direction	L	Slower currents dominated by coarser sediments	L	L
Ryde to Culver Cliff	Moderate wave energy predominantly from east to south east	M	Faster currents - large sand deposits present 'Ryde Sands'	L	M
East to South					
Culver Cliff to Dunnose	Moderate, protected from westerlies but fully exposed to east and south easterlies. fetch over 200km	M	Active cliff development (erosion) local beaches a variety of defence measures in place (groynes, sea wall etc)	L	M
Dunnose to St Catherine's Point (The Undercliff)	Dynamic area of coast maximum fetch 150km undefended areas at risk during storm attack	M	Large areas protected by defences (man made) and gravel beaches	L	M
South to West					
St Catherine's Point to The Needles	Exposed to swell waves and energetic local waves maximum fetch of 4000km over which very large waves propagate	H	One of most exposed coastlines in south east England. Sea wall at Freshwater – remainder of coast is exposed	H	H
West to North					
The Needles to Cliff End	Exposed to waves from west, north west and south west	H	Although some protection from the needles remains exposed with rapidly eroding coastline and fast sediment transport	M	H
Cliff End to Old Castle Point	Fetch limited waves generally less than 1 m in height	L	Sheltered, weak littoral drift, localised shoreline stabilisation, limited beach nourishment	L	L

5.3.3 In general the areas to the north of the Isle of Wight are considered low risk as they face the sheltered waters of the Solent and wave generation is limited by a small fetch. Areas to the north east and east are considered medium risk as they are more exposed but are subject to the less dominant easterly waves rather than more dominant westerlies and although fetch distances may reach 200km waves are still considered fetch limited. In addition these areas of coast are generally more protected with a variety of sea defence measures in place including groynes, sea walls and revetments. Areas to the south and the south east are the most exposed with fetch distances of over 4000km and few defences in place. This area of coast is considered to be one of the most exposed in south east England. Areas to the northwest are again considered low exposure as waves are fetch limited, the coastline is well sheltered and some defence measures are in place.

Defining the buffer zone

5.3.4 The exposure map produced needs to take into account tidal data for the Isle of Wight. Areas that are low lying and have high tides are considered at greatest risk as a function of wave height and spray. Tidal inundation is considered in Section 3.3, as such the exposure risk buffer focuses on areas beyond the extent of Flood Zone 2. Land within the extents of Flood Zones 2 and 3 are covered by the requirements of NPPF.

5.3.5 The Exposure Risk classifications have been used to inform the width of the buffer zone. Spray can travel many metres inland and even under calm conditions, coastal fog or mist carrying salt water particles is common. However, although damaging to building material over time through chemical weathering processes this type of spray or 'sea mist' is not considered to be a risk in relation to wave impact. Instead it is the distance larger particles can travel when picked up and transported by extreme wave events which present the greatest risk. Under extreme storm conditions gravel and even boulders may be picked up and thrown inland but over relatively short distances. Sand particles may travel further and 'sand blasting' of buildings can be very damaging during storm conditions.

5.3.6 Three buffer widths (Table 5.4) have been created and applied to the Isle of Wight coastline based upon the low, medium and high risk exposure risk classification.

Table 5.4 Exposure risk and buffer width

Exposure risk	Buffer width (m)
High	100
Medium	50
Low	10

5.3.7 The buffer widths are estimates of the distances which wind and wave processes may transport particles.

5.4 Using the wave exposure risk buffer in development management decisions

5.4.1 The Exposure Risk Buffer is intended to highlight areas which are outside the Environment Agency Flood Zones 2 and 3, within which it may be considered appropriate to require development proposals to demonstrate as part of the planning application that the potential risks associated with wind and wave action have been considered in the building design.

5.4.2 The buffer width is determined by the expose risk classification and not by ground elevation. Thus there are likely to be areas of high ground which have been included in the buffer zones. It is suggested that the exposure risk, and therefore the need for building design considerations, be reviewed on a site by site basis. Based on the wave height data available for review in this assessment, a suggested guide for identifying those sites where mitigating building design should be considered would select site where the ground level is less than the sum of:

- The 1:200 year tide level for the year 2115 (see Figure A8 in Appendix A); and
- 4m, which represents the peak wave heights recorded in 2008, represented to one significant figure.

5.4.3 This guide accounts for predicted climate change induced sea level rise and recorded peak wave heights. The type and availability of sediment should also be considered when assessing the risk to specific sites. Areas of gravel beaches for example should be noted as a potential higher risk during extreme storms due to the supply of larger potentially more damaging particle sizes. Sand areas should also be considered as these will supply smaller particle sizes that may be transported over larger distances.

Mitigation measures – building design

5.4.4 These areas are outside the tidal inundation zones as such it is unlikely that there will be any requirement for floor level adjustment. In these areas, the risk is associated with spray and the debris and sediments that it may contain, as such appropriate mitigation would include the use of toughened glass in sea facing windows and doors. The choice of building material should also be informed by the risk of the building being impacted by potentially corrosive salt water.

6. Flood risk management through planning

This section discusses how flood risk can be managed through the spatial planning process. Avoidance is the principal method of managing flood risk and is discussed further in this section. If, in exceptional circumstances, development is proposed in areas of flood risk, guidance is proposed on managing the risk through site layout and building design.

6.1 Sequential approach

6.1.1 Through the planning process, NPPF aims to reduce the flood risks faced by future developments, and advocates a risk avoidance approach to spatial planning. The flood risk tables from PPG on Flood Risk and Coastal Change have been reproduced in Appendix D of this SFRA for reference purposes. A sequential risk-based approach to determining the suitability of land for development in flood risk areas is central to the Policy Statement and should be applied at all levels of the planning process.

6.1.2 Application of the sequential approach to spatial planning reinforces the most effective risk management measure – that of avoidance.

6.1.3 The sequential approach offers a simple decision making tool that is designed to ensure that areas of little or no risk of flooding are developed in preference to areas at higher risk. NPPF notes that LPAs should make the most appropriate use of land to minimise flood risk, by planning the most vulnerable development in the lowest known risk areas. However, it is recognised that there are cases when development within higher risk zones is unavoidable.

6.2 Sequential test

6.2.1 The Sequential Test[17] is a decision making tool designed to ensure that areas at little or no risk of flooding are developed in preference to areas of higher risk. It is a key component of the hierarchical approach to avoiding and managing flood risk.

6.2.2 The SFRA has mapped flood risk zones on the Island (Figure A3 in Appendix A). Table 6.1 Appropriate landuses for given flood risk zonesTable 6.1 presents details of land use types appropriate[18] for each zone. Further guidance on the appropriateness of land use types for each zone are presented in Table D.2 (in Appendix D). There are several key points that the Council should consider when applying the Sequential Test, these are outlined below.

- Increasing the vulnerability of a site by proposing an alternative use of a higher vulnerability (even if consistent with the risk) is considered an increase in flood risk and not in line with the principles of NPPF;
- The most vulnerable land uses should be allocated first, in areas of least risk; and
- Placing less vulnerable uses in low risk areas and thus reducing the amount of available space for more vulnerable uses in the lower risk zones is not appropriate. Such a situation can only be considered if it can be demonstrated that the only suitable site for the low vulnerability land-use is in the area of low risk; and

[17] NPPF Paragraph: 019

[18] Appropriate = as defined by Table D.2 in Appendix D of this report, reproduced from NPPF

- If land in Flood Zone 3a has to be utilised, development should be steered towards the areas of lowest hazard within that zone. The information presented in Section 3 can be used to inform this process.

Table 6.1 Appropriate landuses for given flood risk zones[19]

Flood Zone	Probability	NPPF Landuse Guidance
Flood Zone 3b	Functional Flood Plain	Only the water compatible uses and the essential infrastructure listed in Table D.2 (Appendix D) should be permitted in this zone. Development should be designed and constructed in such a way to: ▶ remain operational and safe for users in times of flood; ▶ result in no net loss of floodplain storage; ▶ not impede water flows; and ▶ not increase flood risk elsewhere Essential Infrastructure in this zone should pass the Exception Test
Flood Zone 3a	High	This Zone is the Environment Agency's Flood Zone 3 (September 2018). The water compatible and less vulnerable uses of land in Table D.2 are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone. The more vulnerable and essential infrastructure uses in Table D.2 should only be permitted in this zone if the Exception Test is passed. All developments in this zone should be accompanied by a FRA.
Flood Zone 2	Medium	The water compatible, less vulnerable and more vulnerable uses of land and essential infrastructure in Table D.2 are appropriate in this zone. Subject to the Sequential Test being applied, the highly vulnerable uses in table D.2 are only appropriate in this zone if the Exception Test is passed. All development proposals in this zone should be accompanied by a FRA
Flood Zone 1	Low	All uses of land are appropriate in this zone. Other sources of flooding should be reviewed.

6.2.3 All development within Flood Zones 3a, 3b and 2 are subject to the successful application of the Sequential Test. For example, a commercial development is appropriate within Flood Zone 3a, but it should have passed the Sequential Test first.

Screening of SHLAA sites

6.2.4 A total of 379 sites identified through the SHLAA have been screened for flood risk, against the EA Flood Zone 2 and 3 datasets. This has assisted with selecting sites for Level 2 Assessment, giving a clear picture of fluvial and tidal flood risk to the potential sites allocated for development and representing a step on the Sequential Test.

6.2.5 Figure A11 in Appendix A assigns the colours used in Table 6.1 to each site, displaying the highest flood zone that is intersected by the site boundary. An attributed shapefile is also provided through this SFRA.

Other sources of flooding

6.2.6 Surface water flood risk is the main source of risk outside of fluvial and tidal to development on the Island. When considering the Sequential Test, the potential extent of surface water flow routes and ponding areas (Figure A6, Appendix A) should be reviewed.

[19] Reproduced from NPPF Table 3, Paragraph 67

7. Flood risk management through design

Where possible, flood risk will be managed through avoidance following a sequential approach, however, when unavoidable the Exception Test can be applied to allocate development within higher risk zones. This section details the Exception Test and further options to manage flood risk through design.

7.1 The Exception Test

7.1.1 The Exception Test recognises that there will be some exceptional circumstances when development within higher risk zones is unavoidable. The allocation of necessary development must still follow the sequential approach and where exceptions are proposed, the Exception Test must be satisfied.

7.1.2 Flood mitigation measures should be considered as early as possible in the design development process to reduce and manage the flood risks associated with development. This section describes how flood risk can be managed through development design.

7.1.3 If the Sequential Test shows that it isn't possible to use an alternative site, the Exception Test is required if the development is classified as:

- highly vulnerable and in flood zone 2;
- essential infrastructure in flood zone 3a or 3b; and
- more vulnerable in flood zone 3a.

Passing the Exception Test

7.1.4 NPPF states that the Exception Test should only be undertaken after the Sequential Test has been applied. The successfully applied Sequential Test must demonstrate that there are no other reasonably alternative sites available in zones of lower flood risk. This is an essential evidence base and should be considered a prerequisite for any development proposed in a zone of flood risk.

7.1.5 Once the Sequential Test has been applied and passed, NPPF requires the following criteria to be met to pass the Exception Test:

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and
- a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

7.1.6 Both elements of the test will have to be passed for development to be allocated or permitted.

Flood Risk Assessment requirement of the Exception Test

7.1.7 The Exception Test requires a FRA, demonstrating that the proposed development will be safe, without increasing the flood risk elsewhere. To achieve this, NPPF identifies a number of factors which need to be considered:

- Safe access and egress;
- Operation and maintenance;
- Design of development to manage and reduce flood risk wherever possible;
- Resident awareness;
- Flood warning; and
- Evacuation procedures.

7.1.8 These key aspects are expanded in Section 7.2, where flood risk management is discussed in terms of design and emergency responses.

7.2 Flood risk management through design

7.2.1 Flood risk management by design should only be considered after the sequential approach has been applied to development proposals. The sequential approach is applicable both in terms of site allocation and site layout. Only when it has been established that there are no suitable alternative options in lower risk areas, should building design solutions be considered to facilitate development in flood risk areas.

7.2.2 The sequential approach to land use planning on sites can mitigate some of the flood risks, however, there will be instances where a level of risk remains. In these circumstances, flood risk management through design is required. This would need to be addressed as part of site-specific FRA. The following sections provide some over-arching guidance to the Isle of Wight when considering planning applications.

Development controls

7.2.3 Under exceptional circumstances, following the application of the Sequential Test, where development is proposed in areas of flood risk, it will be necessary for the design to incorporate certain flood risk management elements. The following paragraphs describe some of these control measures.

Development adjacent to a main river

7.2.4 Figure A1 (in Appendix A), illustrates the extent of the Environment Agency's main rivers. To ensure that flood risk is considered as part of a development along the banks of any of these watercourses, a buffer zone along both banks has been implemented by the Environment Agency. The Environment Agency's seeks to avoid any proposed development within 8 metres of the bank of a main river, or 16 metres from the landward toe of any fluvial flood defence requires Environment Agency consultation. All development proposals within this zone should involve consultation with the Environment Agency.

7.2.5 The Environmental Permitting (England and Wales) Regulations 2016 require a permit to be obtained for certain flood risk activities which will take place:

- on or within 8 metres of a main river (16 metres if tidal)
- on or within 8 metres of a flood defence structure or culvert (16 metres if tidal)
- on or within 16 metres of a sea defence

- involving quarrying or excavation within 16 metres of any main river, flood defence (including a remote defence) or culvert
- in a floodplain more than 8 metres from the river bank, culvert or flood defence structure (16 metres if it's a tidal main river) and you don't already have planning permission.

Development in flood risk areas

7.2.6 Development within a fluvial flood risk area will be subject to Development Controls, including:

- The provision of safe access and egress - The FD2320/TR1 Report[20] (DEFRA, 2005) Section 7.5.3 states that 'new developments are required to provide safe access and exit during a flood'. Measures by which this will be achieved should be clear in the site-specific FRA. Safe access and exit is required to enable the evacuation of people from the development, provide the emergency services with access to the development during a flood and enable flood defence authorities to carry out necessary duties during the period of flood. A safe access or exit route is a route that is safe for use by occupiers without the intervention of the emergency services. FD2320/TR1 emphasises that a route can only be completely safe in flood risk terms if it is dry at all times. However it is recognised that this is not always practicable, necessitating more detailed analysis.
- The specification of finished floor levels - Finished floor levels of more vulnerable uses should be above the predicted 1 in 100 annual probability water levels plus climate change and inclusive of a freeboard allowance. The freeboard allowance used may be site specific and will depend on developers' discussions with the LPA and the Environment Agency. Typically freeboard is 300 mm if the site is behind hard defences and 600mm if not. Ideally less vulnerable land uses should also have floor levels that do not flood and this arrangement should be sought wherever possible.
- No increase in building footprint - The footprint of buildings should not be increased post re development without mitigation to compensate for lost floodplain storage space. Such schemes should be discussed in detail with the LPA and the Environment Agency.
- Provision of compensatory storage - Compensatory storage will be required if the proposed development increases the built footprint in the floodplain. The resulting loss of floodplain storage will require compensation, through the lowering of land levels elsewhere within the site. Compensation should be provided for flood events less than and including the 1 in 100 year annual probability plus climate change event. Storage should be provided on a level for level and volume for volume basis, so that the behaviour of the floodplain during a flood event remains unchanged. All proposals requiring compensatory storage should be discussed with the LPA and the Environment Agency.

Development in areas designated as the functional floodplain (Zone 3B)

7.2.7 Development in the functional floodplain should be avoided in line with the Sequential Approach presented in NPPF. Only water compatible uses will be permitted providing there is no reduction on flood conveyance or flood storage. Less vulnerable, more vulnerable and highly vulnerable uses are not permitted in Zone 3b. Essential infrastructure may be permitted providing the Exception Test is satisfied.

[20] https://www.thenbs.com/PublicationIndex/documents/details?Pub=DEFRA&DocID=275716

Development in surface water flood risk areas

7.2.8 In accordance with NPPF, any new development proposed in Flood Zones 2 or 3, or in Flood Zone 1 if the site is greater than 1 hectare, must include a site-specific FRA. This will be reviewed by the EA for development proposed in Zones 2 or 3a and 3b, and by the Council otherwise. It is recommended that the site threshold for triggering a Drainage Impact Assessment as part of a Planning Application is 0.25 hectares. These Drainage Impact Assessments should be inclusive of a consideration of surface water drainage and measures to mitigate against any potential increase in run off. In addition to this, Figure A6 should be reviewed to assess whether the site is within a zone of potential surface water flood risk. As part of these assessments, Southern Water should be contacted to discuss the proposed method of managing surface water.

7.2.9 Site specific FRAs should consider the local drainage infrastructure in detail. When preparing site specific FRAs the impact of blocked drains and the likely consequences should be established. If necessary it might be appropriate to slightly raise ground floor levels to reduce potential damages. This is not a requirement of NPPF, it is just a means of reducing the impact of a potential risk. Such mitigation should be supported by evidence to demonstrate that surface water flow routes are not altered to the extent that the risk of flooding is made worse elsewhere.

7.2.10 An area identified at risk from surface water flooding, either from flood mapping or from historical records, should not be excluded from development solely on that basis. Surface water flooding can often be carefully managed and good site design may not only reduce the risk of flooding on site but could also help alleviate flooding problems downstream from the development.

7.2.11 The management of runoff during the construction period is an important consideration, particularly for large sites and details of measures to mitigate for this phase of development are required as part of an FRA. The Water Framework Directive (WFD) places specific requirements on the management of non-point source pollution such as that from construction site silts. Methods to reduce the volume of solids (and runoff) leaving the site include:

- Phased removal of surface vegetation at the appropriate construction phase;
- Provision of a grass buffer strip around the construction site and along watercourses;
- The covering of stored materials;
- Ensuring exposed soil is re-vegetated as soon as feasibly possible;
- Protection of storm water drain inlets; and
- Silt fences, siltation ponds and wheel washes.

Consideration of climate change

7.2.12 Managing climate change and the associated heightened flood risks are key components of NPPF. Site specific FRAs should take into account climate change, for at least the next 100 years, unless it can be demonstrated that the development will have lifespan of less than 100 years in which case a shorter horizon would be considered acceptable, upon agreement with the LPA and the Environment Agency.

7.2.13 The potential impacts of climate change on river flows and on sea level rise in the Isle of Wight have been strategically assessed as part of this Level 1 SFRA. Further detail is provided in Section 4.

7.2.14 In line with the principals of risk avoidance, site layout should seek to avoid the predicted flood extents. If this is not possible, risk management should be undertaken through design. As such it is recommended that finished floor levels for more vulnerable or highly vulnerable landuse types of a site should reflect the 2115 1 in 200 year predicted tide level plus an appropriate freeboard allowance.

7.2.15 The LPA has taken the view that the tidal flood zones held by the Environment Agency should be superseded with tidal flooding predictions which provide an allowance for climate change. As such the assessment of tidal flood risk at the potential development site level uses the 1 in 200 year flood extent (in the year 2115) to represent tidal flood zone 3 and it utilises the 1 in 1000 year flood extent (in year 2115) to represent tidal flood zone 2. This approach reflects the LPAs determination to achieve sustainable coastal development. Please consult Figure E1 in Appendix E for tide level predictions around the Island.

Freeboard allowance

7.2.16 Predicted flood water levels alone, are not necessarily sufficient to inform finished floor levels. An additional freeboard may be required to account for uncertainties and in tidal area, the action of waves. In all instances, the Environment Agency should be consulted to establish the necessary freeboard allowance for the proposed development.

Basements

7.2.17 It is recommended that habitable rooms in basements should not be permitted in Flood Zones 2 or 3. Adaptation of existing properties, to include a basement for habitable rooms should be discouraged in Flood Zones 2 and 3. It is however recognised that the implementation of this may be challenging, as basement development is sometimes classified as Permitted Development when within the bounds of the existing building.

7.2.18 Basements for less vulnerable uses or non-habitable rooms must be designed with safe internal escape. Each application should be discussed with the LPA and the Environment Agency. Site specific analysis should accompany any proposal, to demonstrate that a proposed basement would not impede the flow of groundwater in such a way that the risk of groundwater flooding elsewhere is increased.

Access and egress

7.2.19 In exceptional circumstances, pending successful application of the Sequential Test, development may be proposed in areas of flood risk. In such an event, safe escape routes to outside the flood risk zone should be incorporated into site designs to facilitate safe evacuation of the site. Additional detailed modelling of watercourses may be required to provide the necessary flood levels and speeds of onset and flood hazard classifications needed to inform safe evacuation routes. Safe routes should be identified both inside and beyond the site boundary of the new development. Even where a new development is above the floodplain and is considered to be acceptable with regard to its impact on flood flows and flood storage, it should be demonstrated that the routes to and from the development are also safe to use. Safe escape routes should be intuitively designed, so that they remain logical routes of escape during a flood event. In many cases, the adaptation of the normal access an egress routes so that they remain safe is the preferable option, rather than the engineering of routes specifically for use in flood events. Where possible, new development should aim to provide dry escape for the lifetime of the development.

7.2.20 Guidance on evacuation and safe refuge in the event of a flood event is provided in the Isle of Wight Council's Flood Warning and Evacuation Plan Guidance[21].

[21] https://www.iow.gov.uk/azservices/documents/2782-Isle-of-Wight-Council-Flood-Warning-and-Evacuation-Plan-Guidance-2017-Final-v1-April-2017-v1.pdf

7.3 Building design

7.3.1 The final step in the flood risk management hierarchy is to mitigate through building design. NPPF considers this as the least preferred option and should not be used in place of the sequential approach to land use planning on a site.

7.3.2 The Department for Communities and Local Government has published guidance on improving the flood performance of new buildings. The guide identifies a hierarchy of building design which fits within step 5 of the flood risk management hierarchy of NPPF (assess, avoid, substitute, control and mitigate). This is set out below:

- Flood avoidance:

  Constructing a building and its surrounds (at site level) to avoid it being flooded (e.g. by raising it above the flood level).

- Flood resistance:

  Constructing a building in such a way to prevent flood water entering the building and damaging its fabric.

- Flood resilience:

  Constructing a building in such a way that although flood water may enter the building its impact is reduced (i.e. no permanent damage is caused, structural integrity is maintained and drying and cleaning are facilitated).

- Flood reparable:

  Constructing a building in such a way that although flood water enters a building, elements that are damaged by flood water can be easily repaired or replaced.

7.3.3 The EA Guidance on Flood Risk Assessment: Local Planning Authorities[22] sets out to help the designer determine the best option or design strategy for flood management at the building site level, based on knowledge of basic flood parameters (e.g. depth, duration and frequency), these factors would normally be determined by the site specific FRA during the planning application process. Depending on these parameters (in particular depth) and after utilising options for flood avoidance at site level, designers may opt for a water exclusion strategy or a water entry strategy, as illustrated in Figure 7-1.

[22] https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities

Figure 7-1 Flexible and risk averse approaches to flood risk management and safe development

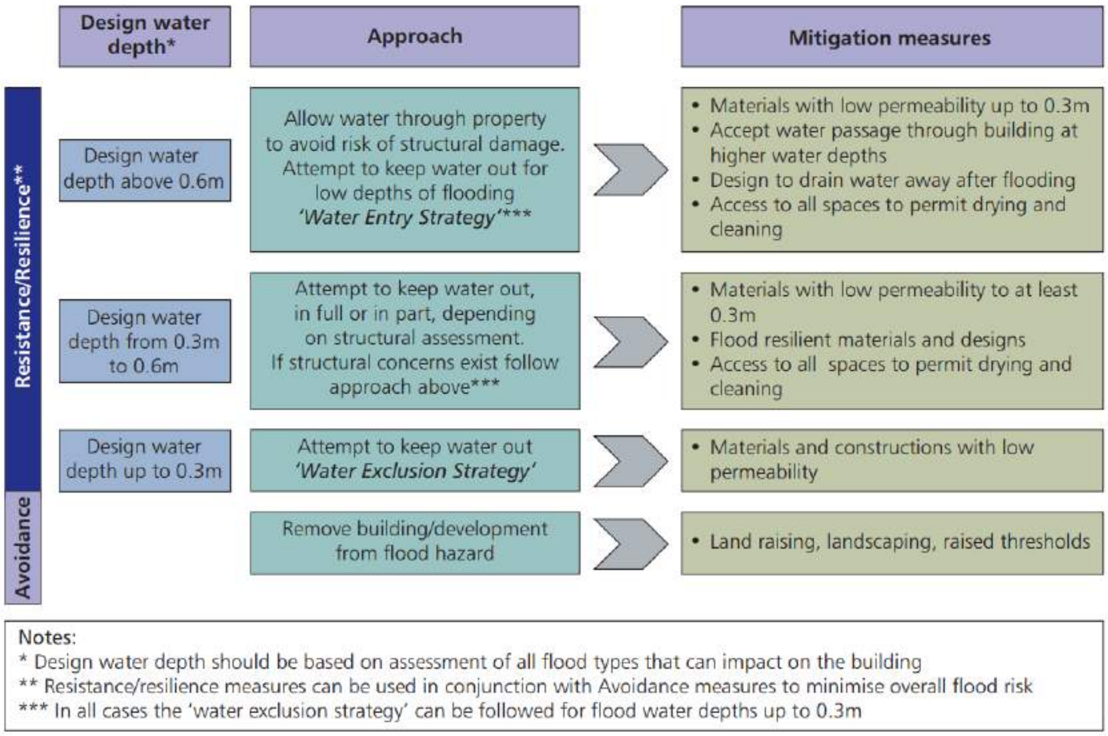


Figure taken from "Improving the Flood Performance of New Buildings – Flood Resilient Construction"[23]

7.3.4 In a Water Exclusion Strategy, emphasis is placed on minimising water entry whilst maintaining structural integrity, and using materials and construction techniques to facilitate drying and cleaning. This strategy is favoured when low flood water depths are involved (up to a possible maximum of 0.6m).

7.3.5 In a Water Entry Strategy, emphasis is placed on allowing water into the building facilitating draining and consequent drying. Standard masonry buildings are at significant risk of structural damage if there is a water lever difference between outside and inside the building of about 0.6 m or more. This strategy is therefore favoured when high flood water depths are involved.

7.4 Flood warnings

7.4.1 The Environment Agency provides flood warnings for on the Isle of Wight for the following areas that include:

- Coastal areas at Sandown;
- Coastal areas of Seaview and Spring Vale;
- Coastal areas at Yarmouth, Isle of Wight;
- Coastal areas at Ryde;
- Carisbrooke, Hunny Hill and Newport Quay Arts Centre on the Lukely Brook;

[23] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/7730/flood_performance.pdf

- St John's Station to The Strand at Ryde from the Monktonmead Brook;
- Coastal areas at Cowes and East Cowes, and tidal areas of Newport;
- Coastal areas at Gurnard;
- Coastal areas of Wootton, Wootton Bridge and Fishbourne;
- Coastal areas at Bembridge;
- Afton to School Green Road and Brookside Road at Freshwater;
- Horringford, Langbridge and Alverstone on the Eastern Yar;
- Gurnard Pines to Marsh Road at Gurnard from the Gurnard Luck;
- Sandown, Yaverland, Yarbridge, Brading and Bembridge on the Eastern Yar; and
- Blackwater and Newport on the River Medina

7.4.2 It is important to note that the Environment Agency flood warnings will not be able to provide advance warning for all different flood mechanisms. Warnings will not give advance notice of flooding from structural failures, culvert blockages or from groundwater. Intense rainfall events may also generate localised and severe rapid onset floods that are very difficult to predict.

7.4.3 The Agency's flood warnings are provided for existing developments at risk from flooding. They should not be considered as a mitigation measure for new and planned developments.

7.4.4 Further guidance on flood warnings and their associated actions are provided in the Isle of Wight Council Flood Warning and Evacuation Plan Guidance[24].

[24] https://www.iow.gov.uk/azservices/documents/2782-Isle-of-Wight-Council-Flood-Warning-and-Evacuation-Plan-Guidance-2017-Final-v1-April-2017-v1.pdf

8. Sustainable management of surface water

This section summarises appropriate SuDS guidance for new development on the Isle of Wight, based on national policy requirements and best practice guidance.

8.1 Introduction

8.1.1 Sustainable Drainage Systems (SuDS) are an approach to managing surface water that replicates natural drainage. The key objectives are to manage the flow rate and volume of runoff at the source, to reduce risk of flooding and improve water quality. From 6 April 2015, the Planning Practice Guidance for Flood Risk and Coastal Change (PPG) was amended to provide a stronger emphasis on the usage of SuDS. LPAs are required to ensure that SuDS are incorporated in all major development plans where appropriate, and make sure that there are arrangements in place for ongoing maintenance over a development's lifetime.

8.1.2 LLFAs are statutory consultees for surface water drainage, and are required to take account of new "non-statutory" national SuDS standards that have been introduced[25] as part of the update to NPPG.

8.1.3 From a drainage perspective, these FRAs and Drainage Impact Assessments need to detail how surface water is currently managed on site and how it is proposed to be managed post development. The discharge route (e.g. surface water drains or an open watercourse) should be detailed and it is important that there is evidence of either Southern Water or Environment Agency consultation which includes approval of the discharge. These assessments should describe how current run off rates and volumes are managed, for brownfield site development this should include details of how rates and volumes will be reduced. If a reduction in runoff rates and volumes is not proposed the assessment must provide evidence to explain why this cannot be achieved.

8.1.4 The Isle of Wight Council is the Lead Local Flood Authority and in this role they will be required to act as the SuDS approval body.

NPPF and PPG

8.1.5 The NPPF and its associated PPG advises that developers should use SuDS to manage runoff at source, replicate the natural hydrological cycle as closely as possible and reduce the pressure on downstream drainage networks, thus helping to manage flood risk to downstream development. SuDS should be incorporated into the site layout as an integral part of the development. Preference should be given to open-air SuDS formed as part of the development's green space to maximise the benefits SuDS can provide by improving water quality, and providing for amenity, recreation and wildlife. The PPG acknowledges that SuDS may not be applicable for all sites, for instance if there are pre-existing concerns about flooding. However, SuDS ought to be provided unless it is demonstrated that they are not appropriate for a particular development.

8.1.6 When planning SuDS, the developer must consider construction, operation and maintenance requirements, both above and below the ground surface. The capacity of the system should be designed to take into account the design storm, allowances for future climate change, and likely changes in impermeable area over the lifetime of the development (the Local SuDS Officer Organisation practice guidance specifies a range of allowances for future urban creep). The

[25] https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards - Non-statutory technical standards for sustainable drainage systems

suitability, or otherwise, of SuDS for a particular site is determined by the LPA, in consultation with the LLFA.

8.2 What is sustainable surface water management and where should it be applied?

8.2.1 The applicability of SuDS techniques for use on potential development sites should, as far as is practicable, conform to the SuDS hierarchy[26]:

- Store rainwater for later use;
- Use infiltration techniques, such as porous surfaces in non-clay areas;
- Attenuate rainwater in ponds or open water features for gradual release;
- Attenuate rainwater by storing in tanks or sealed water features for gradual release;
- Discharge rainwater direct to a watercourse;
- Discharge rainwater to a surface water sewer/drain; and
- Discharge rainwater to the combined sewer.

8.2.2 Wherever possible, SuDS are designed to provide environmental enhancement by improving water quality, biodiversity, and landscape and amenity value. Although SuDS are generally designed at the site-specific scale, they should also give consideration to their ability to provide larger scale benefits to the wider area.

8.2.3 The main driver for incorporation of SuDS into new and existing developments is at national level, from the NPPF, with accompanying guidance being provided by the Department for the Environment, Food and Rural Affairs (Defra). LLFAs provide local guidance on how developers should incorporate SuDS into development, including detail on what information should be provided and how it should be presented for planning.

8.2.4 The design and implementation of sustainable drainage solutions should be factored into the design of any new development. This follows best practice, but also it is a fundamental requirement of NPPF that new development does not result in an increase in surface water run-off rates post development.

8.2.5 The Isle of Wight Council have an aspiration to see run-off rates and run-off volumes reduced from the current condition on previously developed sites, as listed in the Island Plan.

8.3 Appropriate use of SuDS

8.3.1 The selection of appropriate SuDS is dependent upon many key influences, including:

- local hydrology and hydrogeology;
- ground contamination;
- depth of water table;
- soil permeability;

[26] https://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx

- ground stability;
- sensitivity of receiving waterbody (either surface water or groundwater);
- size of catchment area;
- development type, density and required layout;
- requirements for local flood risk management;
- other opportunities within the overall site; and
- affordability of scheme (capital and operational).

8.3.2 The SuDS Manual identifies four processes that can be used to manage and control runoff from developed areas. Each option can provide opportunities in varying degrees for storm water control, flood risk management, water conservation and groundwater recharge:

- Infiltration;
- Detention/attenuation;
- Conveyance; and
- Water harvesting.

8.3.3 Proposed and existing land-uses are thought to be a significant factor in deciding appropriate SuDS techniques, as these influence the volume of water required to be attenuated. Existing or historic land uses have the potential to influence the choice of SuDS techniques by informing the likelihood of pollution and potential contamination issues. Indications of the most suitable techniques for individual sites cannot be made at a strategic level, however, since these will be governed by site specific characteristics and other considerations. Therefore, site specific FRAs will provide the required recommendations. The applicability of SuDS techniques can only be assessed in the SFRA through the consideration of regional characteristics relating to the underlying geology.

8.3.4 Table B1 (in Appendix B) CIRIA (2015) provides a summary of influential site characteristics which should be assessed at the site specific level. Section 8.4 describes how the SFRA has reviewed the appropriateness of infiltration SuDS techniques for the whole Island.

8.4 Appropriate use of infiltration SuDS on the Isle of Wight

8.4.1 The section describes how the SFRA has provided an assessment of the suitability of infiltration SuDS techniques. Infiltration SuDS are the preferred option NPPF and as such it is the applicability of this technique which forms the focus of this assessment. The assessments have been performed using Island wide datasets and the findings of which are presented for each site in the Sites Database. Three key factors had to be considered:

- The potential for groundwater contamination – was based upon the Ground Water Source Protection Zones provided by the Environment Agency (Figure A12);
- The infiltration potential – was based on the BGS Groundwater Vulnerability map which classifies soils and geology in terms of the potential for pollutants to be transferred from the surface to aquifers (Figure A13); and
- Mass movement issues – the BGS mapping indicates areas where rotational slips are potentially an issue in these areas the promotion of infiltration is not encouraged (Figure A14).

8.4.2 It should be noted that the 'potential for groundwater contamination' assesses the potential for contaminants to enter groundwater. No assessment has been made of the presence of contaminants or contaminated land. Details on the derivation of the Infiltration Potential, Groundwater Contamination Potential and Infiltration SuDS suitability are provided in Appendix B. Each of the potential development sites included for review in this SFRA has been attributed with the respective infiltration SuDS suitability potential. In all instances site investigation work and consultation with the Environment Agency on the nature of proposed SuDS techniques is recommended.

8.4.3 In locations where infiltration techniques are not appropriate, solutions that attenuate runoff and discharge to surface water (the fluvial water bodies or surface water sewers) are likely to be the most appropriate. Such schemes will require consultation with the sewage undertaker (Southern Water) to determine discharge rates and with the Environment Agency if it is proposed to discharge into a fluvial water body.

Source Protection Zones

8.4.4 The Environment Agency has defined Source Protection Zones (SPZs) for 2,000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. SPZs are further subdivided into the following categories:

- SPZ1 (Inner SPZ – 50 day travel time or 50 metres): designed to protect against the effects of human activity which might have an immediate effect upon the source. SPZ1 was originally based on the need to protect against biological contaminants;
- SPZ2 (Outer SPZ – 400 day travel time or at least 25% of the recharge catchment area): designed to provide protection against slowly degrading pollutants; and
- SPZ3 (Catchment SPZ): covers the complete catchment area of the groundwater source.

8.4.5 There are a number of SPZs on the Isle of Wight, which will act as a constraint when considering the suitability of infiltration SuDS.

8.5 Management of construction site runoff

8.5.1 Construction site runoff is an important area of catchment hydrology, causing local short-term but potentially significant changes in local flood risk.

8.5.2 The clearance of vegetation (and modifications to drainage infrastructure on brownfield sites) may lead to increased runoff above pre-construction rates. The management of runoff during the construction period is an important consideration particularly for large sites and details of measures to mitigate for this phase of development are required as part of an FRA. The WFD places specific requirements on the management of non-point source pollution such as that from construction site silts. Methods to reduce the volume of solids (and runoff) leaving the site include:

- Phased removal of surface vegetation at the appropriate construction phase;
- Provision of a grass buffer strip around the construction site and along watercourses;
- The covering of stored materials;
- Ensuring exposed soil is re-vegetated as soon as feasibly possible;
- Protection of storm water drain inlets; and
- Silt fences, siltation ponds and wheel washes.

8.6 Using the SFRA to inform SuDS suitability

8.6.1 Infiltration/discharge to groundwater SuDS techniques are considered amongst the most sustainable solutions as maintenance requirements are comparatively low and the systems do not discharge to watercourses or the sewage undertakers piped drainage network.

8.6.2 Figures A12 and A13 indicate Groundwater Vulnerability and Infiltration Potential respectively. These maps are based on the British Geological Society aquifer types and Hydrology of Soil Types database. Areas of high groundwater vulnerability are likely to coincide with areas of high infiltration potential.

8.6.3 The SFRA mapping does not preclude the need to undertake site specific investigations and consultation with the Environment Agency. Issues of ground contamination, ground water pollution and technical feasibility will all have to be addressed at the site specific level.

9. Flood Risk Assessments and windfall sites

This section provides a summary of the triggers and scope requirements of a potential site-specific FRA, as well as how to proceed with assessment of windfall sites.

9.1 Site specific Flood Risk Assessments

9.1.1 Table 9.1 provides a clear instruction to developers and Planning Officers as to where a FRA is required on the Island. Should any one of the criteria listed in Table 9.1 apply to the site in question then a FRA needs to be prepared to accompany a planning application. The NPPF should provide the basis for establishing the scope of the FRA and the Environment Agency should also be consulted.

Table 9.1 When is a FRA required?

Criteria Requiring a FRA or further investigation	FRA Required (Yes/No)	Scope of the FRA or further investigation
In Fluvial Flood Zone 3b	Yes	Follow the requirements of NPPF
In Fluvial Flood Zone 3a	Yes	Follow the requirements of NPPF
In Fluvial Flood Zone 2	Yes	Follow the requirements of NPPF
Greater than 1 hectare in Fluvial Flood Zone 1	Yes	Follow the requirements of NPPF
Is the site within the extent of the 1:200 year coastal flood event in 2115?	Yes	Follow the requirements of NPPF – i.e. development must be safe inclusive of an allowance for climate change (See Section 7.2)
Greater than 0.25 hectare	Drainage impact assessment required	For all sites over 0.25 hectare in Flood Zone 1 an assessment of surface water drainage will be required with any planning application. This assessment should review the potential to incorporate sustainable drainage techniques and attenuate flows in line with the Councils aspirations.
Within 8m of the bank top of a main river?	Consult Environment Agency Development management	Development is likely to require Environment Agency consent in these areas
Within 16 m of a flood Defence	Consult Environment Agency Development management	Development is likely to require Environment Agency consent in these areas

9.2 Minimum requirements for a Flood Risk Assessment

9.2.1 Having determined that it is required, a FRA should be structured as follows, guidance on what the Isle of Wight Council expect to see in a site specific FRA is outlined in the following sections, which is based on guidance provided in NPPF[27]:

- Section 1 – Development Site Context
- Section 2 – The Development Proposal
- Section 3 – Assessment of Flood Risk

[27] https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications

- Section 4 – Managing flood risk and proposed mitigation measures
- Section 5 – Sustainable drainage proposal

Section 1 - The Site Context

9.2.2 A description of the current site location should be provided, including a location plan showing:

- Street names;
- Any rivers, streams, ponds, wetlands or other bodies of water; and
- Other geographical features, for example railway lines of local landmarks such as schools or churches.

9.2.3 A site plan should be provided, including details of the current landuse/function of the site, supported by maps and/or photographs.

Section 2 - The Development Proposal

9.2.4 This should consist of a description of the development proposal, including a site plan showing:

- Your development proposal; and
- Any structures that could affect water flow, for example bridges, embankments.

9.2.5 For development in Flood Zone 1, a survey should be provided, showing:

- Existing site levels; and
- The levels of your proposed development.

9.2.6 For development in Flood Zones 2 and 3, surveys should also show a cross-section of the site showing local ground levels, finished internal floor and (where relevant) access/egress road levels. Indicate peak flood water levels (which can be obtained from the EA – see Section 9.2.12) on these drawings to demonstrate that an appropriate freeboard allowance has been incorporated into the design.

Section 3 Assessment of Flood Risks

9.2.7 Contact the EA for information about flood risk in your area. The EA can provide a range of "products" or packages of information to assist with the FRA[28]:

9.2.8 The product required is dependent upon the development size and flood zone it is in:

- Non-domestic extensions with a footprint of less than 250 square metres and all domestic extensions
  - flood zones 2 and 3 use product 3
  - flood zone 3 in an area behind raised flood defences use product 8
  - flood zone 1 use product 1
- Applications with a site area less than 1 hectare
  - flood zone 3 choose from products 4, 5, 6, or 7

[28] https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications#get-information-to-complete-an-assessment

  - flood zone 3 in an area behind raised flood defences use product 8
  - flood zones 1 and 2 use product 3
- Applications with a site area greater than 1 hectare
  - flood zones 2 and 3 choose from products 4, 5, 6 or 7
  - flood zone 3 in an area behind raised flood defences use product 8
  - flood zone 1 use product 3.

9.2.9 The EA product can be used in conjunction with this SFRA to form the information base of the FRA. Contact should also be made with the EA for advice on what to do if the development is within 20m of a main river.

9.2.10 For development in Flood Zones 2 and 3, contact should be made with the Isle of Wight Council to check whether a Sequential Test has been applied for the site. If not, this will need to be carried out prior to the FRA.

9.2.11 Flooding from all sources should be assessed (for example surface water and groundwater), as well as from rivers and the sea, including a consideration for climate change.

9.2.12 Development in Flood Zones 2 and 3 also requires an assessment of what the risk would be to the development in the event of a flood. An estimate of the following is required:

- The level for the site relative to a flood event, i.e. the 1 in 100 year river flood level or the 1 in 200 year tidal flood level;
- The duration of a flood;
- The rate of surface water runoff;
- The order in which areas of the site would be flooded; and
- Consequences for people living on or using the site.

The information might be available from the EA or the Isle of Wight Council, or a flood risk specialist can be used to calculate the estimates.

Section 4 – Managing Flood Risk and Proposed Mitigation Measures

9.2.13 Development in Flood Zones 2 and 3 requires consideration of mitigation and resilience measures that could be applied, including:

- details of existing flood resistance and resilience measures on your site – information from the EA or the Isle of Wight Council; and
- the capacity of drains or sewers (existing and proposed) on your site – information from Southern Water.

9.2.14 Additionally, details of how the proposed design will mitigate flood risk should be demonstrated, including details of how people will leave buildings safely during a flood, and how:

- Raised flood embankments or changes to ground levels could affect water flow; and
- Your development could affect rivers and their floodplain or coastal areas.

9.2.15 Sites within the functional floodplain (water compatible development or essential infrastructure developments that have met the requirements of the exception test) must also show that they have been designed to:

- stay safe and operational during a flood;
- avoid blocking water flows or increasing flood risk elsewhere; and
- avoid loss of floodplain storage (i.e. loss of land where flood waters used to collect).

Section 5 - Sustainable drainage proposal

9.2.16 Surface water runoff should be assessed, including:

- an estimate of the rates and volumes of surface water run-off from your development site currently.
- details of existing methods for managing surface water runoff, for example drainage to a sewer;
- your plans for managing surface water and for making sure there's no increase in the volume of surface water and rate of surface water runoff; and
- Proposed discharge locations (e.g. watercourse or Southern Water sewer).

9.2.17 Plans for managing surface water runoff should be in line with the guidance in Section 8 of this SFRA, and with sustainable drainage principles[29].

9.2.18 With the necessary requirements above satisfied, the FRA should be submitted with the planning application to the Isle of Wight Council, who, in conjunction with the EA (if in Flood Zones 2 or 3) will review the FRA and advice whether it is satisfactory.

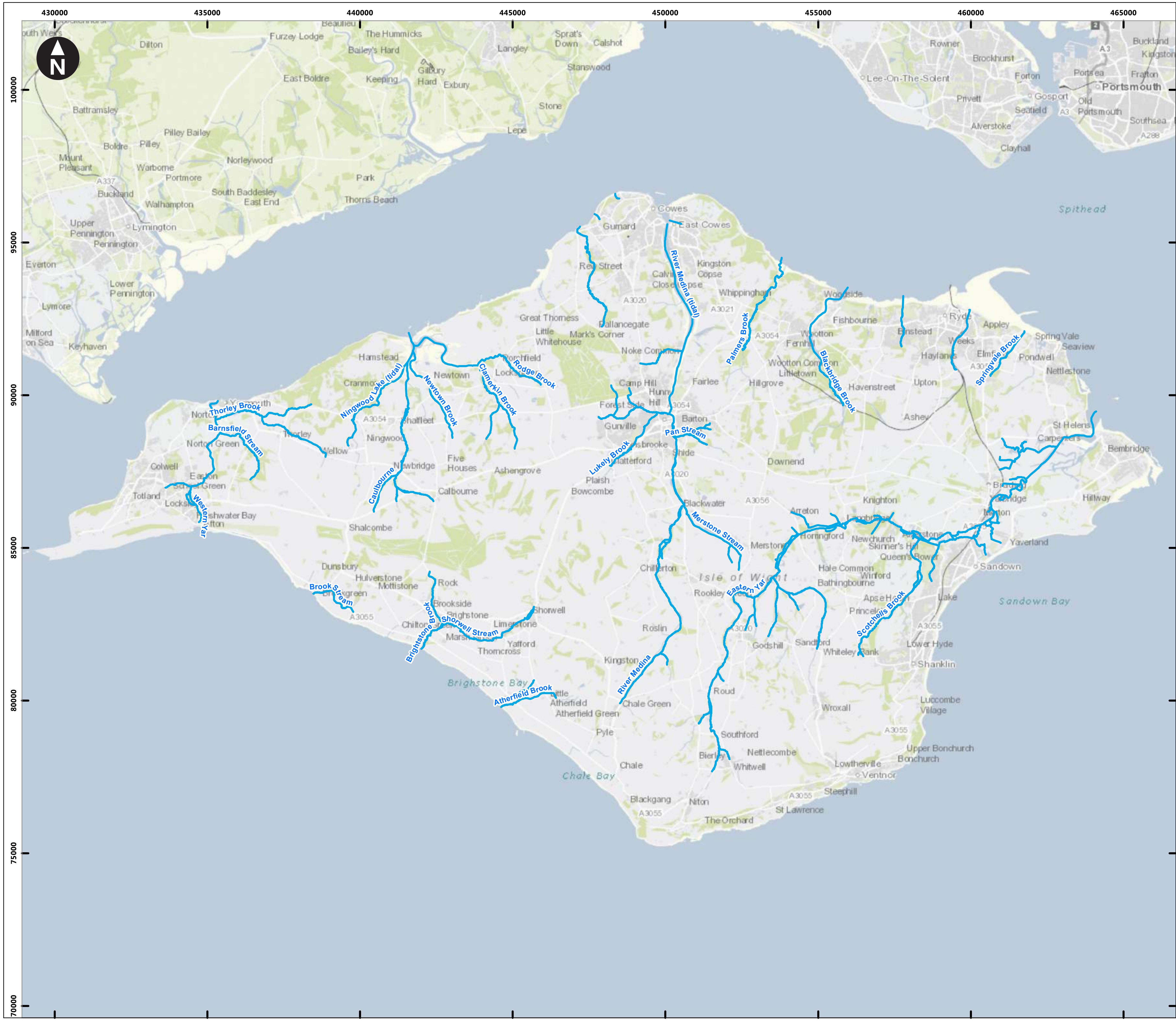
9.3 Windfall sites

9.3.1 Windfall sites refer to sites which become available for development unexpectedly, and are therefore not included as allocated land in a planning authority's development plan.

9.3.2 It is highly likely that there will always be windfall development, and these sites will need to be assessed. The Isle of Wight Local Plan will identify the target areas for growth and redevelopment. The appropriateness for sites outside these areas will need to be addressed on a site by site basis. Proposed windfall development should pass the Sequential Test and Exception Test if required. Additionally, the sequential approach to flood risk management will be required within the development site, and this will need to be addressed within the development proposals and accompanying FRAs.

[29] http://www.susdrain.org/delivering-suds/using-suds/suds-principles/suds-principals.html

Appendix A
Figures



Key

Main rivers

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

ISLE of WIGHT COUNCIL

Isle of Wight
Strategic Flood Risk Assessment

Figure A1
Main Rivers

October 2018

wood.

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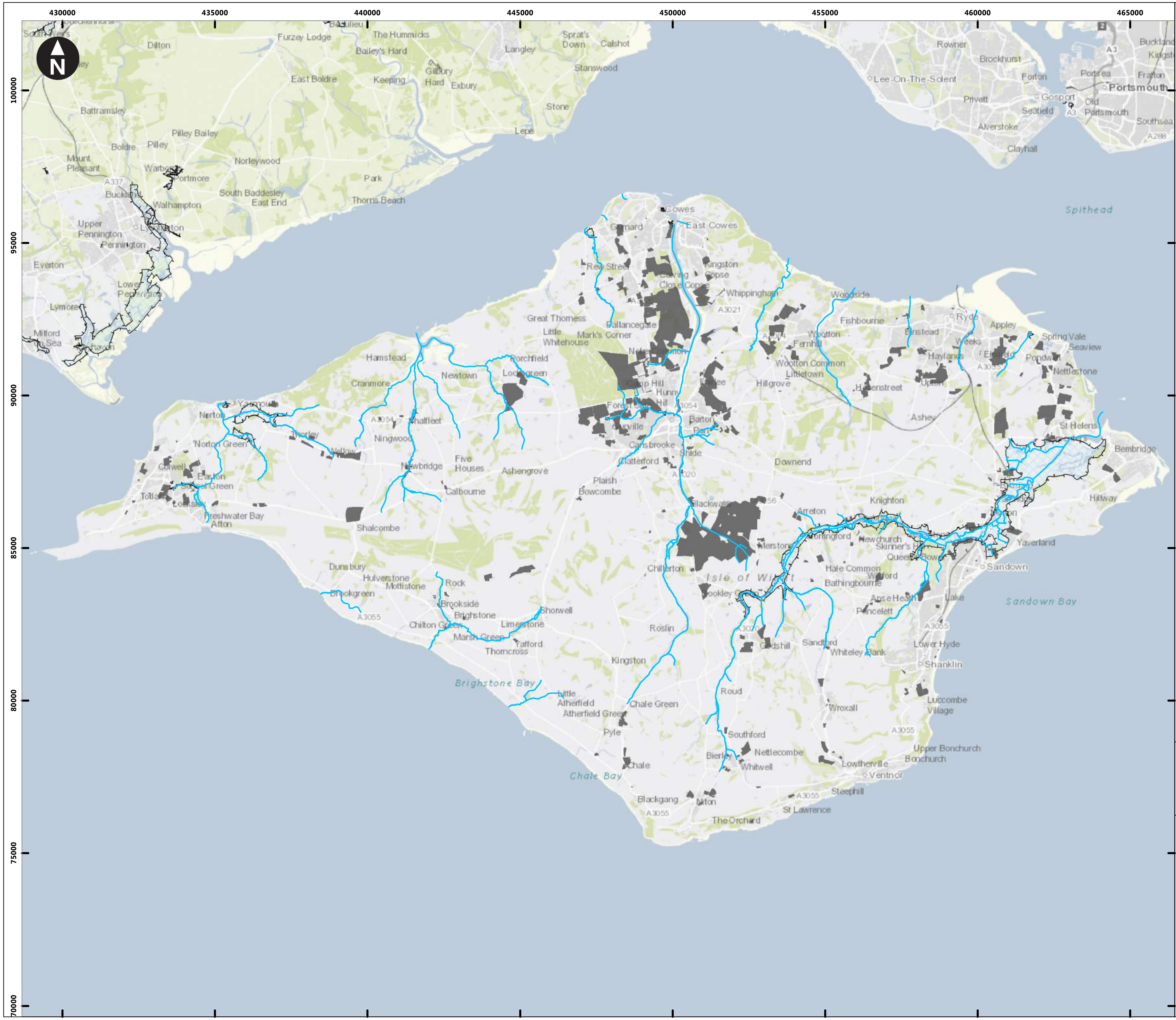

Key

- Potential development sites
- Main rivers
- Historic flood map

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

ISLE of WIGHT COUNCIL

Isle of Wight
Strategic Flood Risk Assessment

Figure A2
Historic Flooding

October 2018

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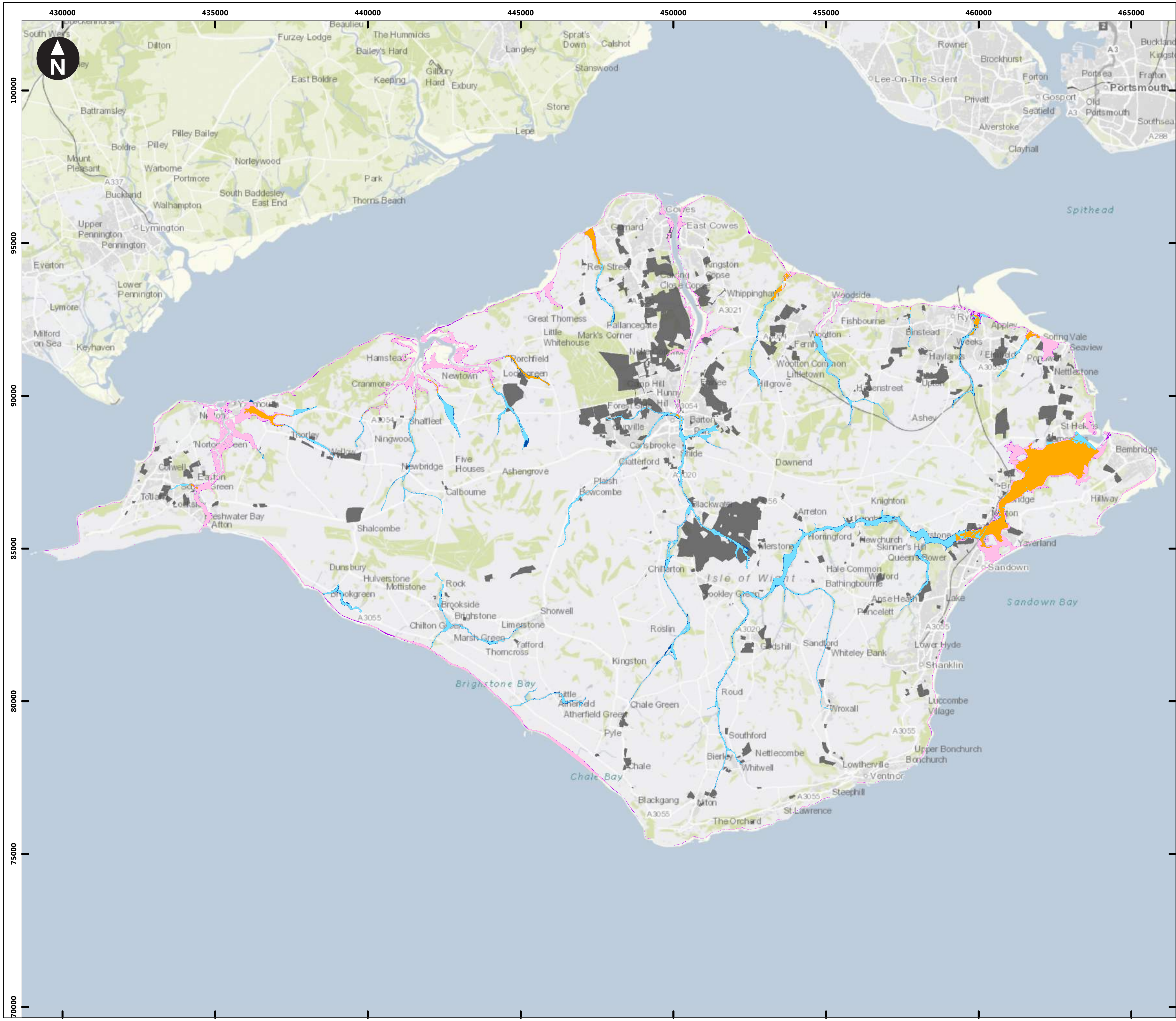

Key

- Potential development sites

Flood Zone 3

- Fluvial Models
- Tidal Models
- Fluvial / Tidal Models

Flood Zone 2

- Fluvial Models
- Tidal Models
- Fluvial / Tidal Models

Flood Zone 2 - land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.

Flood Zone 3 - land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

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Isle of Wight
Strategic Flood Risk Assessment

Figure A3
Fluvial and tidal present day Flood Zones

October 2018

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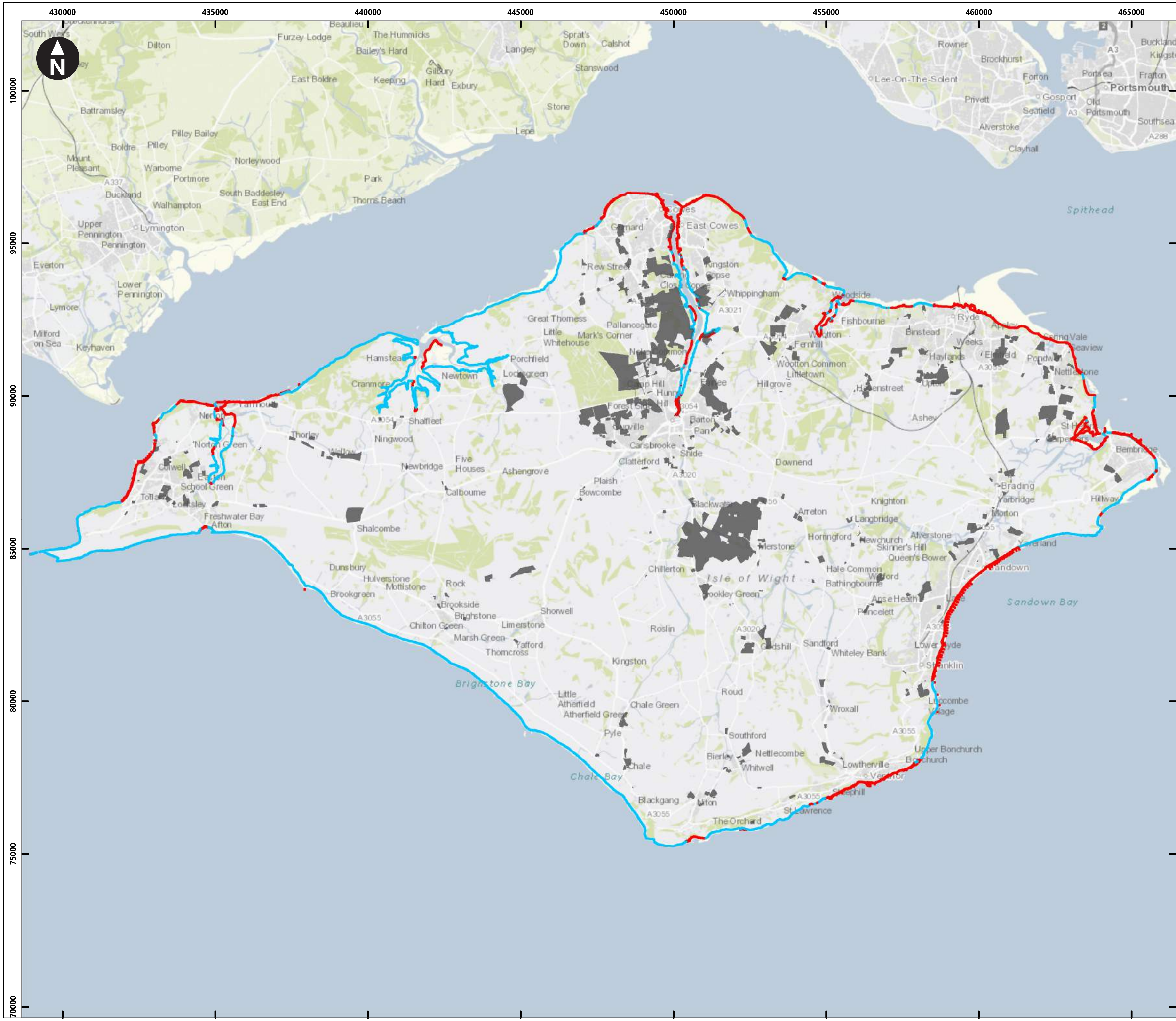

Key

Potential development sites

Defended

Undefended

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

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Strategic Flood Risk Assessment

Figure A4
Flood defence structures

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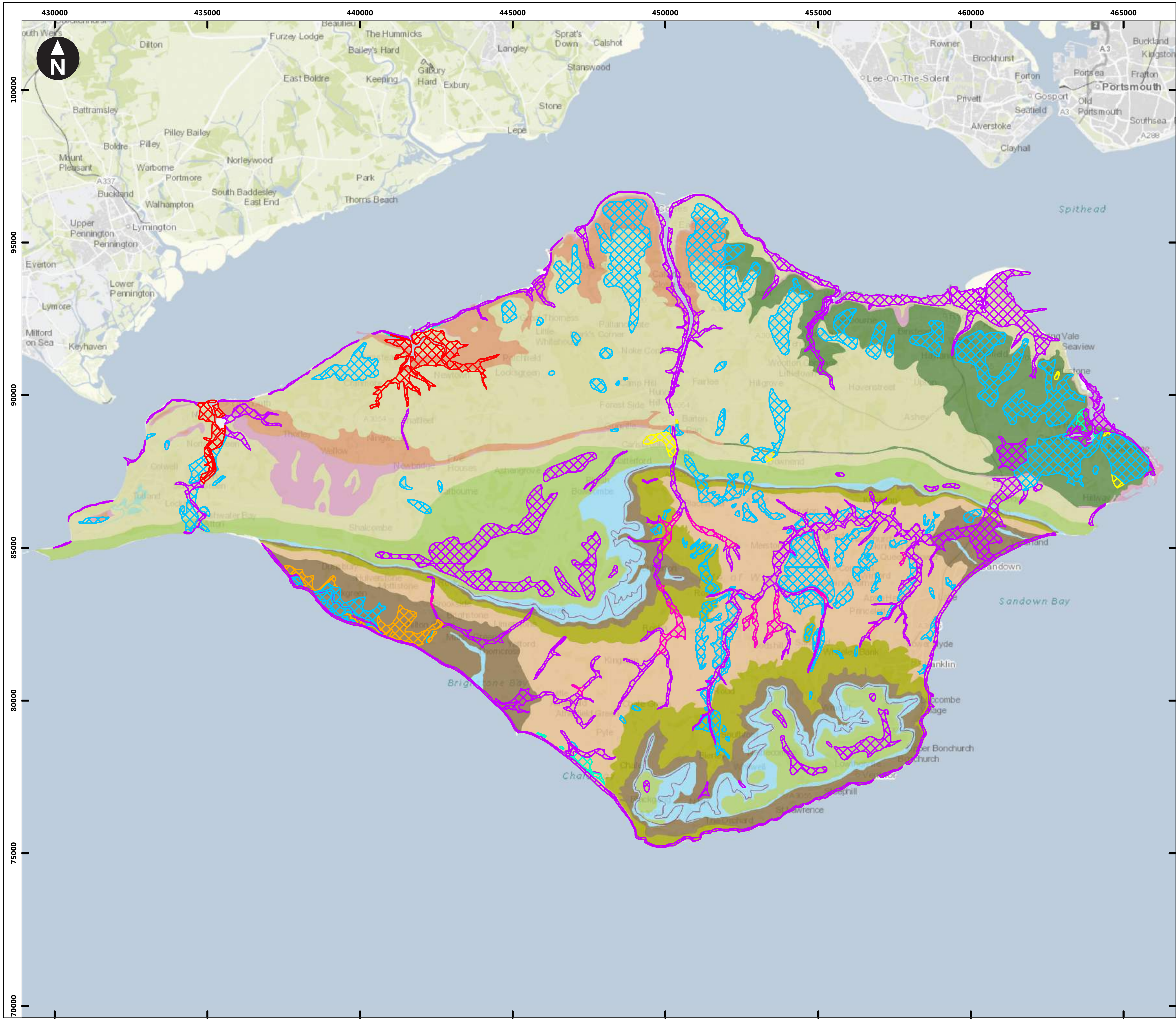

Key

Solid geology

- Calcareous mud
- Chalk
- Clay
- Clay, silt and sand
- Ferruginous sandstone
- Limestone
- Limestone and argillaceous rocks, interbedded
- Mudstone
- Sandstone
- Sandstone and chert
- Sandstone, siltstone and mudstone

Drift geology

- Clay and silt
- Clay, silt and sand
- Clay, silt, sand and gravel
- Peat
- Sand
- Sand and gravel
- Sand, silt and clay

0 1 2 3 4 5 6 7 km
Scale at A3: 1:120,000

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Isle of Wight
Strategic Flood Risk Assessment

Figure A5
Solid and drift geology

October 2018

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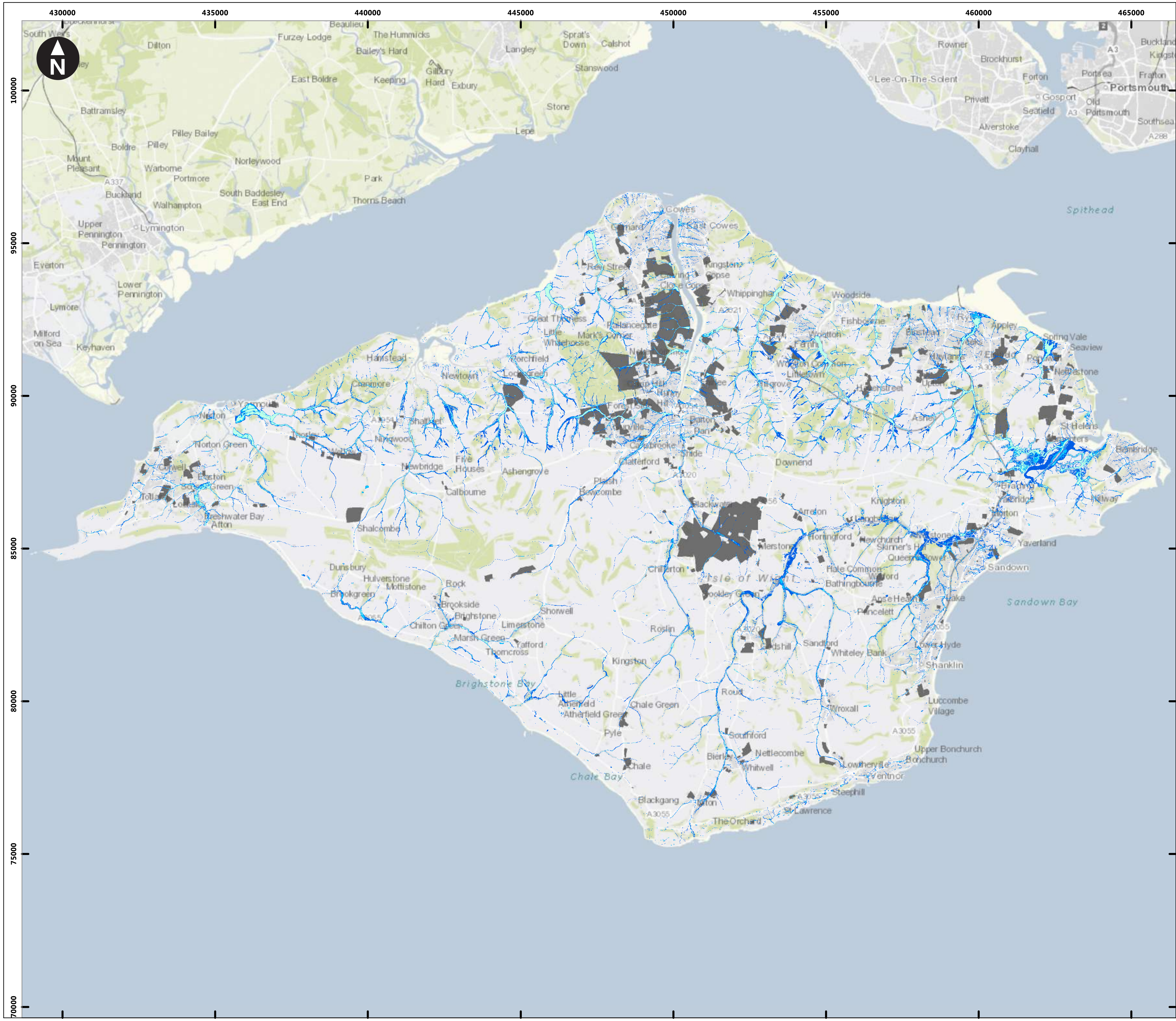

Key

Potential development sites

Risk of flooding from Surface Water - Extent

High risk

Medium risk

Low risk

High risk – land assessed as having a 1 in 30 or greater annual probability of surface water flooding (3.33%) in any year.

Medium risk – land assessed as having between a 1 in 30 and 1 in 100 annual probability of surface water flooding (3.33% - 1%) in any year.

Low risk – land assessed as having a between a 1 in 100 and 1 in 1,000 annual probability of surface water flooding (0.1% - 1%) in any year.

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

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Isle of Wight
Strategic Flood Risk Assessment

Figure A6
Risk of flooding from Surface Water

October 2018

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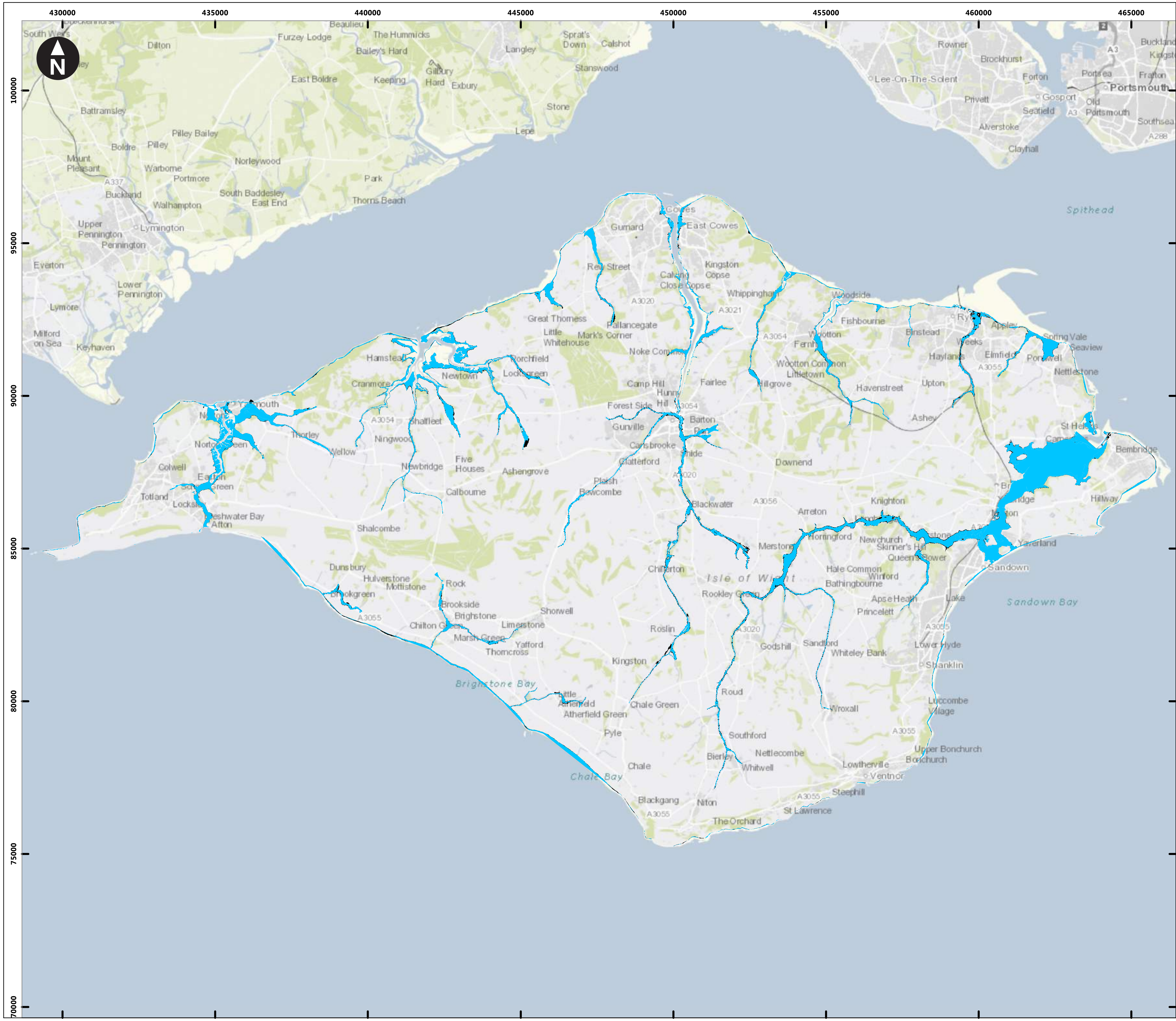

Key

Areas potentiall sensitive to climate shcnage

Flood Zone 3

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

ISLE of WIGHT COUNCIL

Isle of Wight
Strategic Flood Risk Assessment

Figure A7
Areas of floodplain potentially sensitive to climate change

October 2018

wood.

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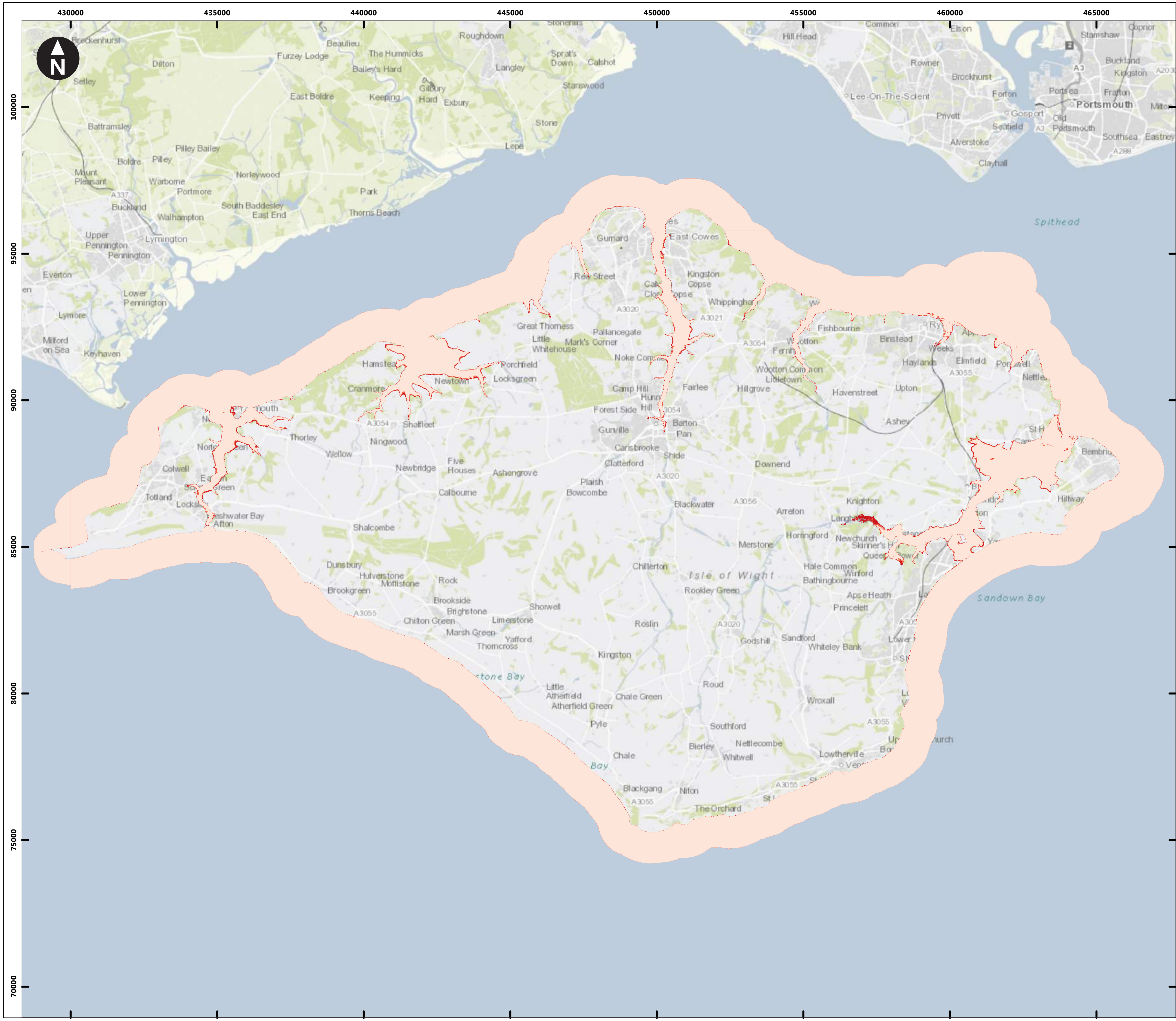

Key

Predicted 1 in 200 year Tidal Extents

- Year 2010
- Year 2045
- Year 2080
- Year 2115

0 1 2 3 4 5 6 7 km

Scale at A3: 1:125,000

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Isle of Wight
Strategic Flood Risk Assessment

Figure A8
Tidal Flood Zone 3 - Climate Change

October 2018

wood.

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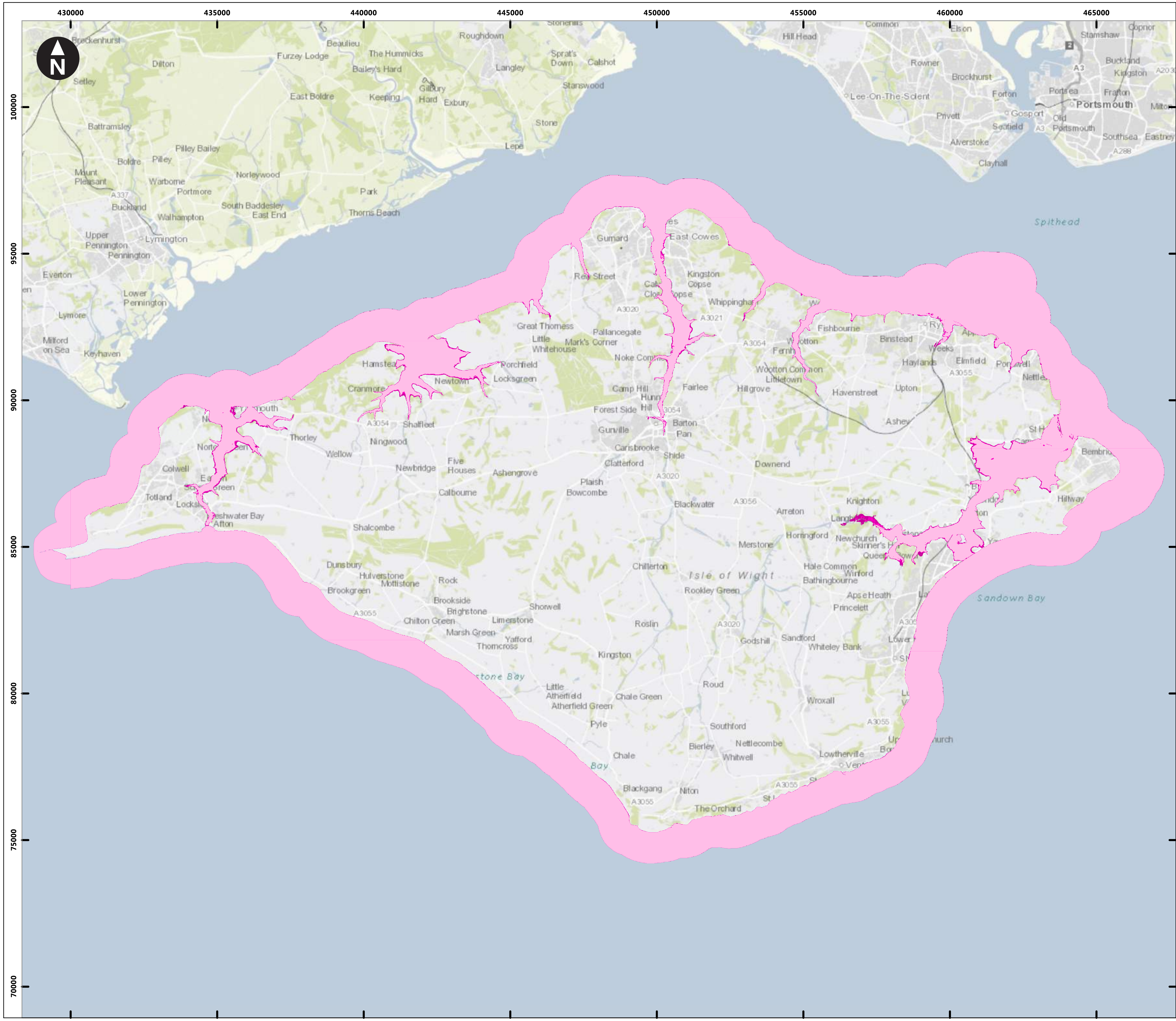

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Key

Predicted 1 in 1000 year Tidal Extents

- Year 2010
- Year 2045
- Year 2080
- Year 2115

0 1 2 3 4 5 6 7 km

Scale at A3: 1:125,000

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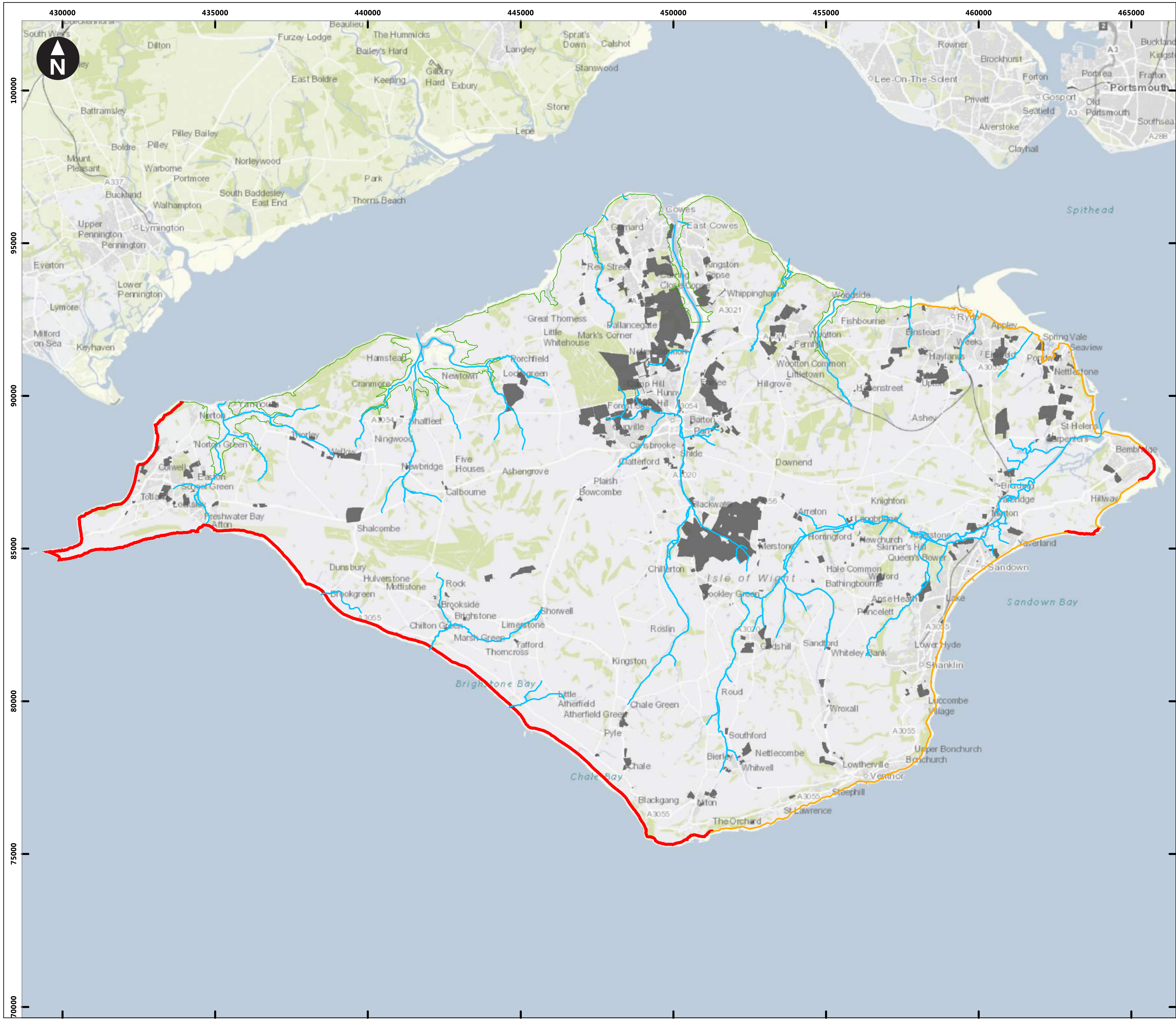
Isle of Wight
Strategic Flood Risk Assessment

Figure A9
Tidal Flood Zone 2 - Climate Change

October 2018

wood.



Key

Potential development sites

Main rivers

Potential exposure risk

High

Medium

Low

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

ISLE of WIGHT COUNCIL

Isle of Wight
Strategic Flood Risk Assessment

Figure A10
Qualitative wind and wave exposure risk

October 2018

wood.

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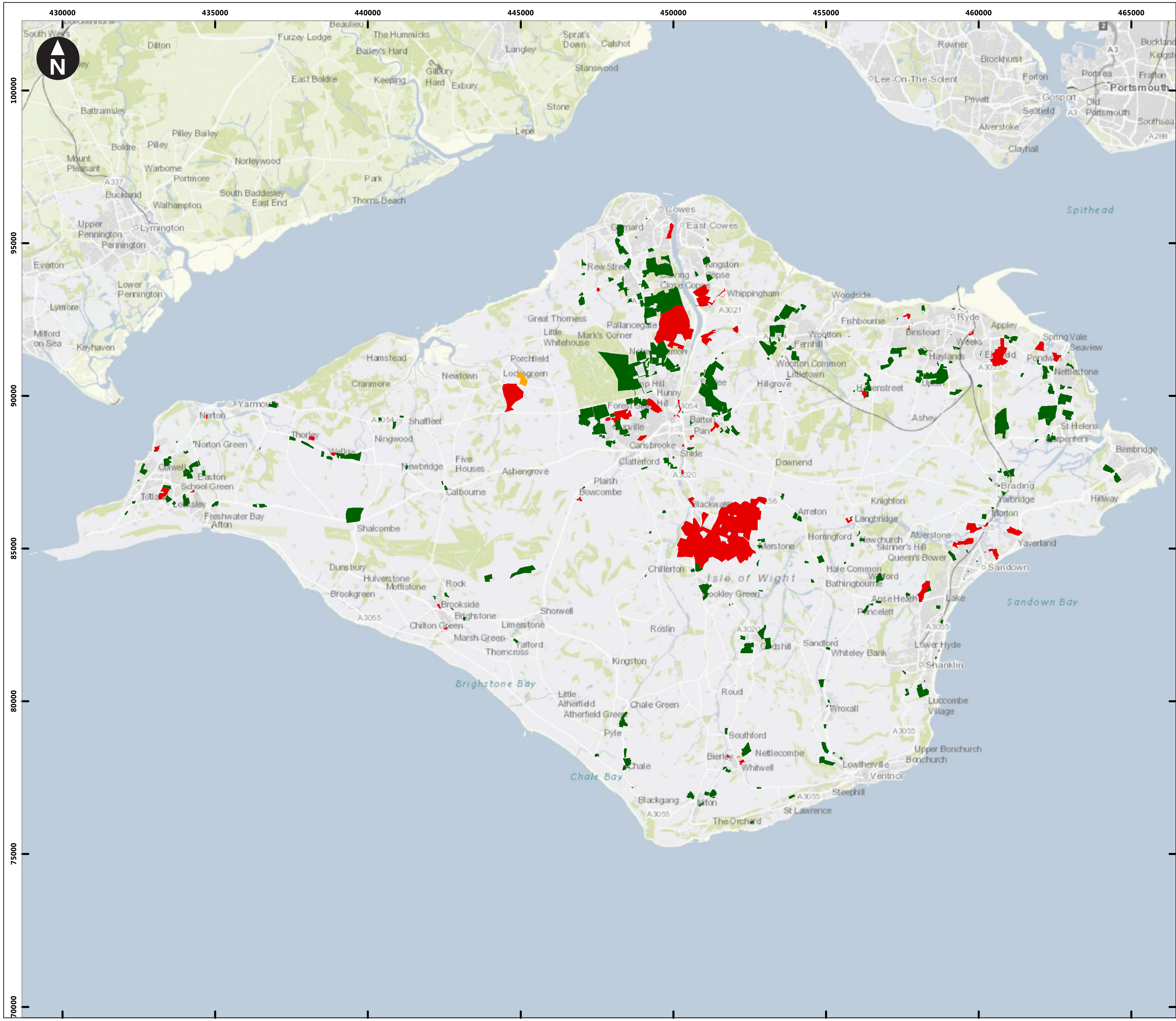

Key

Potential development sites

- Flood Zone 1
- Flood Zone 2
- Flood Zone 3

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

ISLE of WIGHT COUNCIL

Isle of Wight
Strategic Flood Risk Assessment

Figure A11
Potential development sites and their highest associated flood zone

October 2018

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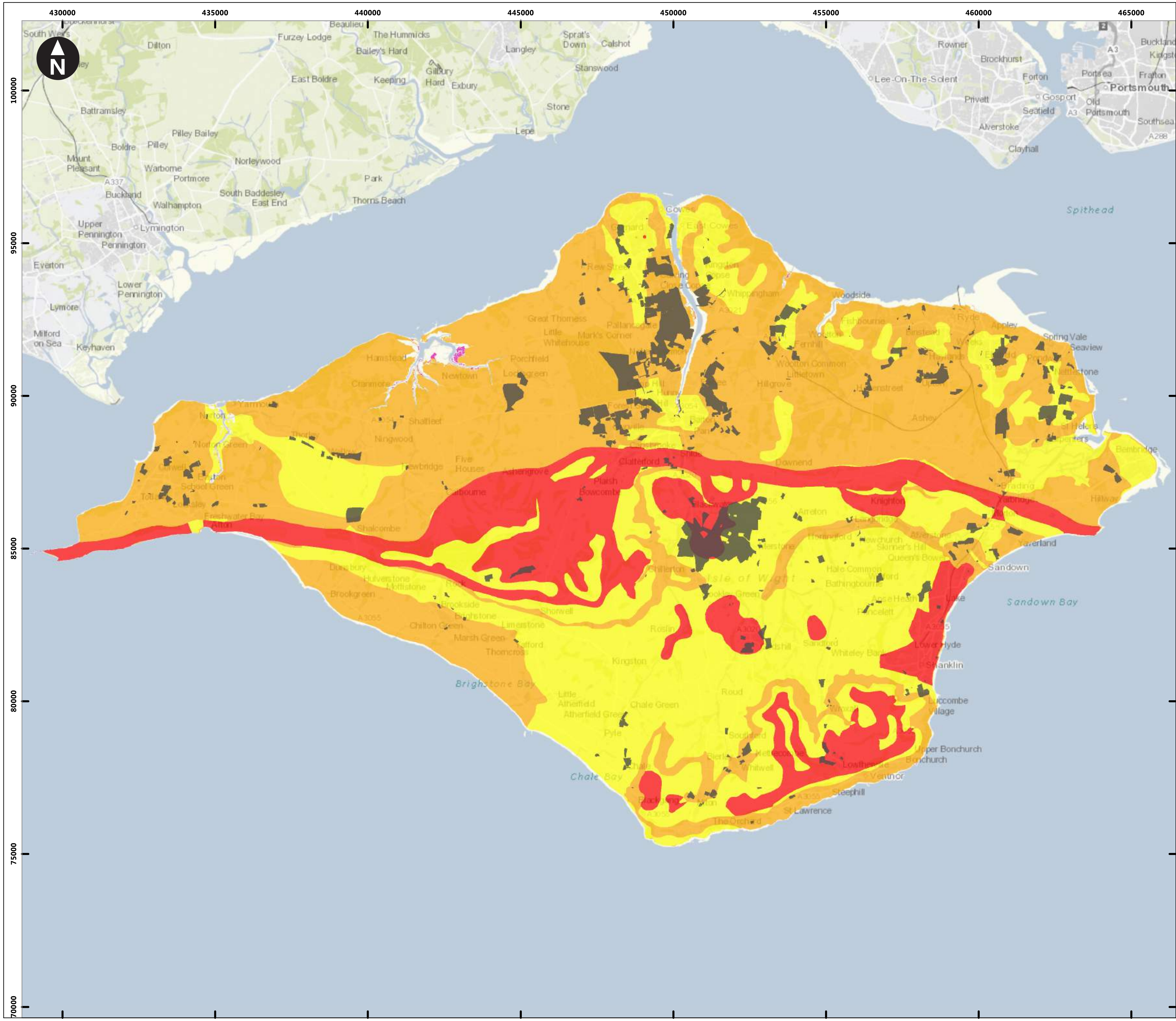

Key

Potential development sites

SuDS groundwater contamination potential

- High
- Low
- Medium
- Unknown

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

ISLE of WIGHT COUNCIL

Isle of Wight
Strategic Flood Risk Assessment

Figure A12
SuDS groundwater contamination potential

October 2018

wood.

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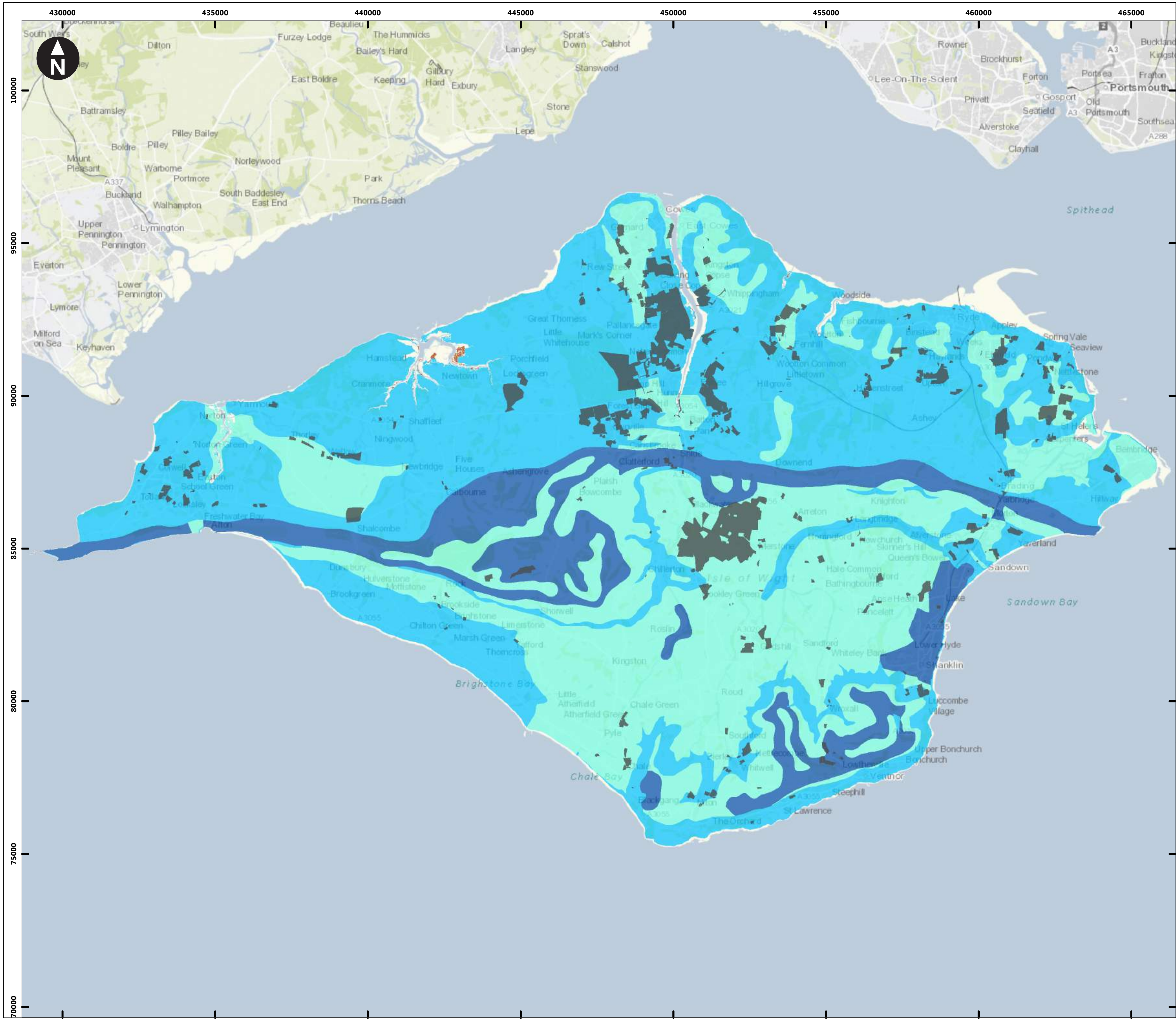

Key

Potential development sites

SuDS infiltration potential

- High
- Low
- Medium
- Unknown

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

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Isle of Wight
Strategic Flood Risk Assessment

Figure A13
SuDS infiltration potential

October 2018

wood.

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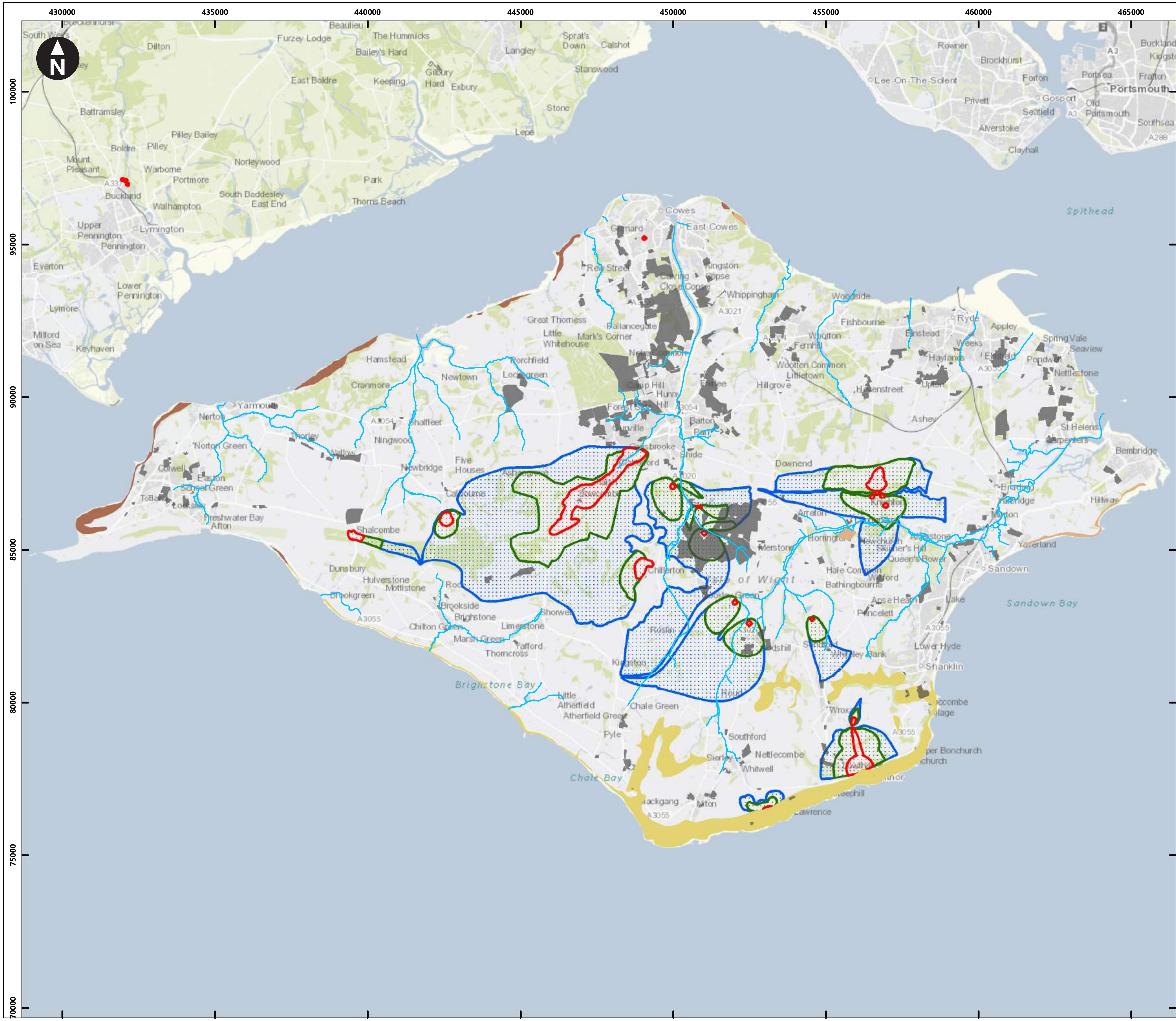

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Key

- Potential development areas
- Main rivers

Mass movement

- Clay
- Rock
- Sandstone and mudstone

Source Protection Zone

- Zone I
- Zone II
- Zone III

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

ISLE of WIGHT COUNCIL

Isle of Wight
Strategic Flood Risk Assessment

Figure A14
Source Protection Zones (SPZs) and areas of mass movement

December 2018

wood.

Appendix B
Supporting SuDS Information

Infiltration Potential

Infiltration techniques generally requiring an infiltration rate of above 10 mm/hr for the upper soil layers (Parrett, 2005) and are thus partially controlled by soil characteristics. The combination of the soil and geological characteristics enable the potential use of infiltration techniques on the site to be assessed. The Groundwater Vulnerability dataset subdivides soils into those with a high, medium and low leaching potential, which can be considered proportional to infiltration potential.

Aquifer assessment

The Groundwater Vulnerability map of the Island also provides details on the aquifer type. It provides an indication of the ability of the underlying rocks strata to absorb water which infiltrates from the overlying soil layer. Without knowledge of site specific soil types and depths, it is not possible to fully assess the infiltration potential. As such, the underlying aquifer type (and its permeability) may limit the infiltration potential and thus the applicability of infiltration SuDS. Three aquifer types exist as defined by the Groundwater Vulnerability map (NRF, 1995):

- Principal Aquifers (Highly Permeable);
- Secondary Aquifers (Variably Permeable); and
- Unproductive Stratas (Negligibly Permeable).

A matrix relating soil infiltration (leaching) potential and aquifer type (permeability) to infiltration potential is presented in Table B.1.

Table B.1 Infiltration potential derived from aquifer vulnerability classification

Aquifer Vulnerability Classification	Description	Infiltration Potential
Minor_L	Variably permeable groundwater with low leaching potential	Low
Minor_I	Variably permeable groundwater with intermediate leaching potential	Low
Minor_H	Variably permeable groundwater high leaching potential	Medium
Major_L	Highly permeable groundwater with low leaching potential	Low
Major_I	Highly permeable groundwater with intermediate leaching potential	Medium
Major_H	Highly permeable groundwater with high leaching potential	High
Non_Aquifer	Regarded as containing insignificant quantities of groundwater. No soils data.	Low

It should be noted that those parts of the Island are classified as 'Non_Aquifer' by the Groundwater Vulnerability map and have no soils information on which to assess infiltration potential. These areas have been considered for the purposes of this SFRA to have a low Infiltration potential. Site Specific FRAs should assess this generalisation at the site specific level.

Mass movement consideration

Mass movement was also considered during the assignment of assessment of the suitability of infiltration SuDS. The process by which mass movement occurs on the Island is through slippage as defined by the BGS map for the Island (Figure A14 – in Appendix A). Thus additional water in areas defined as being prone to slippage may further lubricate the rock strata, thereby potentially inducing a slippage event. Three rock types are associated with areas of slippage on the Island. These are:

- Clay (undifferentiated);
- Sandstone (undifferentiated) and Mudstone; and
- Rock (Undifferentiated).

Mass movement is an important factor in the areas where infiltration SuDS are otherwise suitable, since the addition of water into the soil profile or underlying rock strata has the potential to trigger a mass movement event. It has been considered inappropriate to implement infiltration SuDS techniques in these areas. The Sites Database accounts for this by assigning a low suitability to sites which overlay any of these geologies.

Groundwater contamination potential

The use of SuDS, although a preferred method of managing surface water, has the adverse potential to contaminate groundwater with surface pollutants. Groundwater is known to be vulnerable to contamination from diffuse and point source pollutants through indirect discharges into or onto land. Aquifer remediation is difficult, prolonged and expensive and thus the prevention of pollution is important. The map of Groundwater Vulnerability provides a useful indication of those areas where the implementation of infiltration SuDS techniques has the potential to contaminate the aquifer below through the transfer of pollutants from the surface. It is not a map of contaminated land, rather it is an indication of where there is the potential for groundwater to be polluted.

Source Protection Zones (SPZ's) are defined by the Environment Agency and delineate the risk of groundwater contamination. Figure A14 in Appendix A shows the location of SPZ's on the Island. Generally, the risk is greatest nearest to the abstraction point. The dataset is made up of three main zones, which are the inner, outer and total catchment. A forth zone is sometimes included, and applies to a groundwater source of special interest. The Environment Agency website (Environment Agency, 2007), provides the following definition for each of the SPZ's:

- Zone 1 (Inner protection zone) – Any pollution that can travel to the borehole within 50 days from any point within the zone is classified as being inside zone 1. This applies at and below the water table. This zone also has a minimum 50 metre protection radius around the borehole. These criteria are designed to protect against the transmission of toxic chemicals and water-borne disease.
- Zone 2 (Outer protection zone) – The outer zone covers pollution that takes up to 400 days to travel to the borehole, or 25% of the total catchment area – whichever area is the biggest. This travel time is the minimum amount of time that the Environment Agency believe pollutants need to be diluted, reduced in strength or delayed by the time they reach the borehole.
- Zone 3 (Total catchment) – The total catchment is the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.
- Zone of special interest – This is usually where local conditions mean that industrial sites and other polluters could affect the groundwater source even though they are outside the normal catchment area.

The assessment of groundwater contamination potential

The potential for groundwater contamination was assessed by combining the infiltration potential classifications and the Source Protection Zones. It was considered important to compile a dataset which utilised the most useful available information to provide broad classifications to give an Island wide appreciation of the potential to contaminate groundwater resources.

Unproductive Strata were assigned a low contamination potential, unless they were over a Zone 1 or 2 SPZ, in which case it was given a rating of 'high' or 'medium' respectively. Areas of high infiltration potential were all assigned high contamination risk values as were areas of medium infiltration potential were they were in SPZ zones 1 and 2. The remaining areas of medium infiltration potential were assigned medium contamination potential values. Three classifications, high, medium and low were created. The resultant contamination potential map can be seen in Figure A12 (Appendix A). Table B.2 presents the results of the classification process. Please note, that the impact of mass movement on the infiltration potential has been omitted from this classification process.

Table B.2 Classification of groundwater contamination potential

		Contamination Potential			
		SPZ 1	**SPZ 2**	**SPZ 3**	**No SPZ**
Infiltration Potential	**High**	High	High	High	High
	Medium	High	High	Medium	Medium
	Low	Medium	Medium	Low	Low

The information presented in this section is intended to highlight areas were the simplest of SuDS techniques (i.e. infiltration SuDS) are and are not considered suitable

In line with NPPF development should be appropriate and should not lead to pollution. As such, it is not appropriate to install infiltration systems in land affected by contamination as this could lead to pollution of underlying groundwater.

Supporting SuDS information

SuDS Group	Technique	Soils		Area draining to a single SuDS component		Minimum depth to water table		Site slope		Available head	
		Impermeable	Permeable	0 – 2 ha	> 2 ha	0 – 1 m	> 1 m	0 – 5%	> 5 %	0-1 m	1 – 2 m
Retention	Retention pond	Y	Y[1]	Y	Y[5]	Y[2]	Y[2]	Y	Y	Y	**Y**
	Subsurface storage	Y	Y	Y	Y[5]	Y[2]	Y[2]	Y	Y	Y	**Y**
Wetland	Shallow wetland	Y[2]	Y[4]	Y[4]	Y[6]	Y[2]	Y[2]	Y	N	Y	**Y**
	Extended detention wetland	Y[2]	Y[4]	Y[4]	Y[6]	Y[2]	Y[2]	Y	N	Y	**Y**
	Pond/wetland	Y[2]	Y[4]	Y[4]	Y[6]	Y[2]	Y[2]	Y	N	Y	**Y**
	Pocket wetland	Y[2]	Y[4]	Y[4]	N	Y[2]	Y[2]	Y	N	Y	**Y**
	Submerged gravel wetland	Y[2]	Y[4]	Y[4]	Y[6]	Y[2]	Y[2]	Y	N	Y	**Y**
	Wetland channel	Y[2]	Y[4]	Y[4]	Y[6]	Y[2]	Y[2]	Y	N	Y	**Y**
Infiltration	Infiltration trench	N	Y	Y	N	N	Y	Y	Y	Y	**N**
	Infiltration basin	N	Y	Y	Y[5]	N	Y	Y	Y	Y	**N**
	Soakaway	N	Y	Y	N	N	Y	Y	Y	Y	**N**
Filtration	Surface sand filter	Y	Y	Y	Y[5]	N	Y	Y	N	N	**Y**
	Sub-surface sand filter	Y	Y	Y	N	N	Y	Y	N	N	**Y**
	Perimeter sand filter	Y	Y	Y	N	N	Y	Y	N	Y	**Y**
	Bioretention/filter strips	Y	Y	Y	N	N	Y	Y	N	Y	**Y**
	Filter trench	Y	Y[1]	Y	N	N	Y	Y	N	Y	**Y**
Detention	Detention basin	Y	Y[1]	Y	Y[5]	N	Y	Y	Y	N	**Y**
Open channels	Conveyance swale	Y	Y	Y	N	N	Y	Y	N[3]	Y	**N**
	Enhanced dry swale	Y	Y	Y	N	N	Y	Y	N[3]	Y	**N**
	Enhanced wet swale	Y[2]	Y[4]	Y	N	Y	Y	Y	N[3]	Y	**N**

wood.

Source control	**Green roof**	Y	Y	Y	N	Y	Y	Y	Y	Y	**Y**
	Rainwater harvesting	Y	Y	Y	N	Y	Y	Y	Y	Y	
	Permeable pavement	**Y**	**Y**	**Y**	**Y**	**N**	**Y**	**Y**	**N**	**Y**	**Y**

Y = Yes

N = No

Y[1] = with liner

Y[2] = with surface baseflow

Y[3] = Unless follows contours

Y[4] = With liner and constant surface baseflow, or high ground water table

Y[5] = possible, but not recommended (appropriate management train not in place)

Y[6] = Where high flows are diverted around SuDS component

Note – page numbers in the header should be prefixed with the Appendix letter and <u>must be manually edited</u> for each Appendix section.

Appendix C
SFRA GIS Dataset Descriptions

Source Data Discussion

Many datasets were requested for use in this SFRA, and these were primarily received from the Isle of Wight Council and the Environment Agency. These geographic data had various formats by which they were made available and originated from different sources (e.g. digitised paper maps, survey data and satellite data).

The following is a short description of the source data GIS data used during the course of the SFRA. Where available, the reference scale of the map has been included in order to indicate the maximum scale of use for which the map was intended.

Ordnance Survey Basemap

A high level topographic map which provides an overview of the Island and the RDA's was used as a basemap where detailed ordnance information was not required. This map includes data such as the road network, green areas and contours. The data of this map was captured at 1:50,000 reference scale.

Mastermap

Mastermap data was made available by the IoW Council. This dataset is an accurate source of ordnance survey data that informed the SFRA at RDA and site specific scale. The reference scale of the dataset differs depending on the degree of urbanisation, with urban areas having a capture standard of 1:1,250 while for rural areas detail is reduced.

Potential Development Sites

Potential development sites were supplied the IoW Council and included several different datasets of 'Sites', 'Large Sites' and 'Employment Sites'. This dataset identified those areas on the Island that were/might be considered for development. The reference scale of this dataset is unknown.

Geology

Geological maps of the Island were sourced from the British Geological Society (BGS) on behalf of the Council. The datasets included solid (bedrock), drift (superficial), artificial geological maps, as well as linear geological features and areas of mass movement. The reference scale of these maps are 1:63,360.

Soils

Soils data for the Island was sourced from a national gridded dataset of soils. This dataset is comprised of 1km2 cells with attributed values for the percentage composition of various soils for the cell of interest. The dataset also contains a HOST value for the soils in the cell. Given that the data originated in a 1km2 grid, specific detail about the spatial distribution of soils was lacking

Groundwater Vulnerability

A digital dataset of groundwater mapping was provided by the Environment Agency. These maps show the vulnerability of groundwater as a combination of aquifer type and soils. The reference scale for this dataset is 1:100,000. Since soils data are included in the dataset, it was possible to supplement the less accurate national soils grid.

Source Protection Zones

Source Protection Zones were provided by the Agency for the Isle of Wight. The zones show the risk of contamination from activities that might cause pollution to aquifers used for public water supply. The closer the potential contamination activity is to the abstraction point, the greater the risk classification. The reference scale of this dataset is unknown.

Environment Agency Main Rivers

The main rivers on the Island were sourced from an Environment Agency dataset of rivers defined as larger streams and rivers, including smaller watercourses of local significance.

Fluvial and Tidal Flood Outlines for Zones 2 and 3

The Environment Agency provided a digital dataset of the Island which outlined those areas affected by flooding. The data was divided according to flood zone 2 and 3, as well as fluvial and tidal. This data is sourced from modelling done for the Agency which used Synthetic Aperture Radar (SAR) elevation data.

Environment Agency Flood Model Outlines

The Environment Agency provided flood model outlines of various return periods for some of the rivers on the Island, including the Medina, Monkton Mead and Western Yar. This data was used where necessary, to update the fluvial flood outlines provided by the Agency. The accuracy of the datasets is dependant on the modelling process and its input data.

Historic Flood Outlines

Historic flood outlines were also provided by the Agency. The past flooding events included the years 1974, 1993, 1999 and 2000. The annual exceedence probability of the flood outlines is unknown, and as such, they were used to supplement the existing flood outlines. The reference scale of these outlines is unknown and is dependent on the accuracy of the original data and the scale at which they were digitised.

Flood Defences

The National Flood and Coastal Defence Database from the Agency was the source for the location, extent and level of protection of flood defences on the Island. The reference scale of this dataset is unknown.

Data Precision

Each data source has an associated level of precision. The groundwater water vulnerability mapping has a reference scale of 1:100,000. Whereas LiDAR data has a 1 metre resolution, which means that each 1m by 1m area of land is assigned a single elevation value. Much of the Island wide data (e.g. Groundwater Vulnerability Mapping, Source Protection Zones and Soils Data) come from national data sets, the spatial precision of which is low, but appropriate for strategic Island wide assessments. The individual potential development sites are attributed with values derived from these low precision national datasets (e.g. the generalised classifications of infiltration SuDS suitability, groundwater vulnerability and runoff potential). It must be noted that the precision of the data does not increase despite the analysis being performed on the smaller site specific scale.

It is important that the site specific detail of the datasets covered in the following section be considered in respect to the level of accuracy of the source data. The reference scale of any of the original source data should be deemed as the maximum scale at which the data is considered accurate.

wood.

Appendix D
Tables reproduced from NPPF

Table D.1 Flood zones

Zone 1 Low Probability
Definition
This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)
Appropriate uses
All uses of land are appropriate in this zone.
FRA requirements
For development proposals on sites comprising one hectare of above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be considered in a FRA. This need only be brief unless the factors above or other local considerations require particular attention.
Policy aims
In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of SuDS.

Zone 2 Medium Probability
Definition
This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.
Appropriate uses
Essential infrastructure and the water-compatible, less vulnerable and more vulnerable uses, as set out in Table 2, are appropriate in this zone. The highly vulnerable uses are only appropriate in this zone if the Exception Test is passed.
FRA requirements
All development proposals in this zone should be accompanied by a Flood Risk Assessment.
Policy aims
In this zone, developers and Local Authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage systems.

Zone 3 – High probability
Definition
This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Appropriate uses
The water-compatible and less vulnerable uses of land (Table 2) are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone. The more vulnerable uses and essential infrastructure should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.
FRA requirements
All development proposals in this zone should be accompanied by a Flood Risk Assessment.
Policy aims
In this zone, developers and Local Authorities should seek opportunities to:
Reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
Relocate existing development to land in zones with a lower probability of flooding; and
Create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

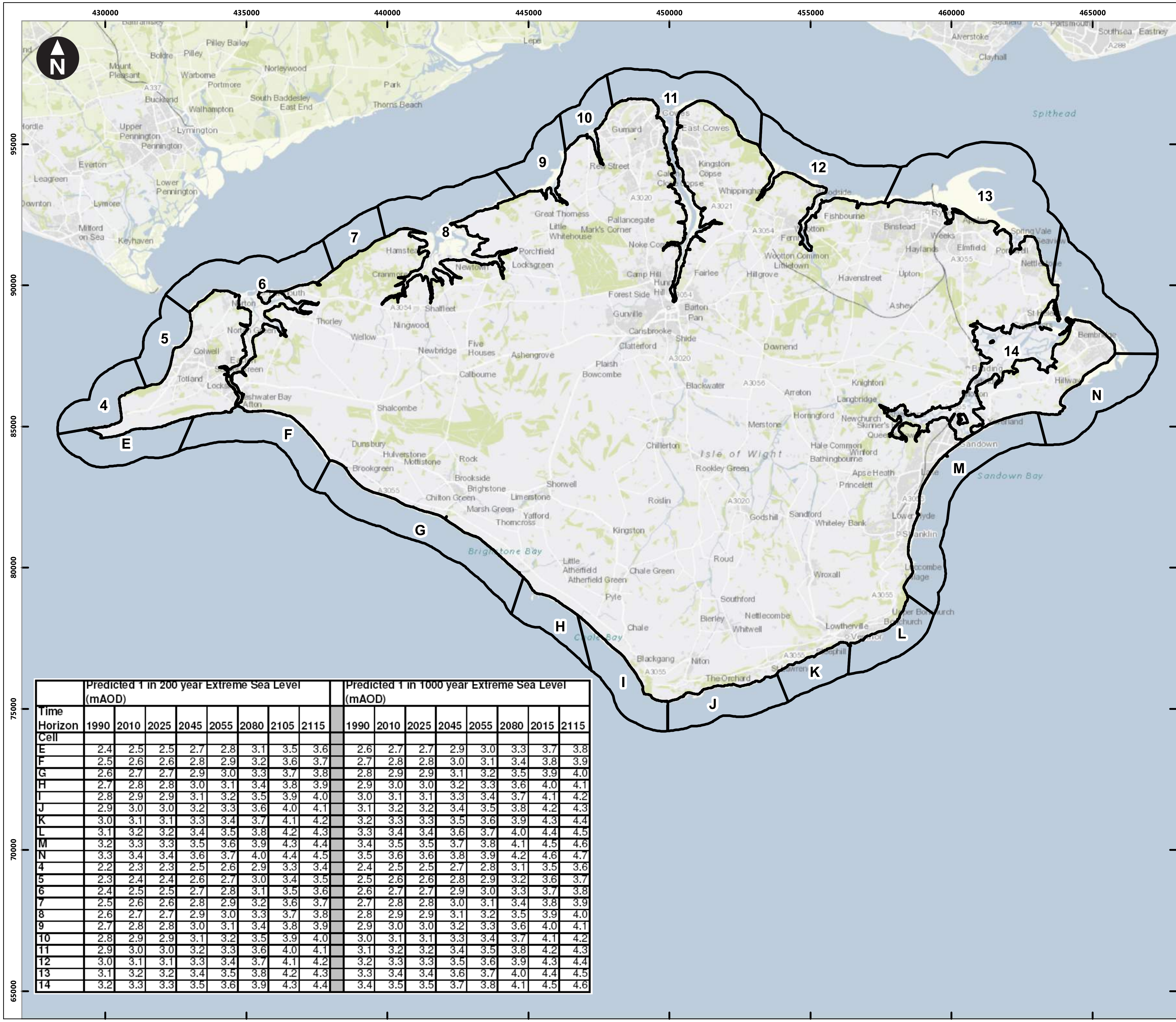
Table D.2 NPPF Flood Risk Vulnerability Classification

Essential Infrastructure	Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
Highly Vulnerable	Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding. Emergency dispersal points. Basement dwellings. Caravans, mobile homes and park homes intended for permanent residential use. Installations requiring hazardous substances consent
More Vulnerable	Hospitals. Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. Non–residential uses for health services, nurseries and educational establishments. Landfill and sites used for waste management facilities for hazardous waste. Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non–residential institutions not included in 'more vulnerable'; and assembly and leisure. Land and buildings used for agriculture and forestry. Waste treatment (except landfill and hazardous waste facilities). Minerals working and processing (except for sand and gravel working). Water treatment plants. Sewage treatment plants (if adequate pollution control measures are in place).
Water-compatible Development	Flood control infrastructure. Water transmission infrastructure and pumping stations. Sewage transmission infrastructure and pumping stations. Sand and gravel workings. Docks, marinas and wharves. Navigation facilities. MOD defence installations. Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. Water-based recreation (excluding sleeping accommodation). Lifeguard and coastguard stations. Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Table D.3 Flood Risk Vulnerability and Flood Zone "Compatibility"

Flood Risk Vulnerability classification (See Table D.2)		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (see Table D.1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b "Functional floodplain"	Exception Test required	✓	×	×	×

Appendix E
Tidal climate change predictions



	Predicted 1 in 200 year Extreme Sea Level (mAOD)									Predicted 1 in 1000 year Extreme Sea Level (mAOD)							
Time Horizon	1990	2010	2025	2045	2055	2080	2105	2115		1990	2010	2025	2045	2055	2080	2015	2115
Cell																	
E	2.4	2.5	2.5	2.7	2.8	3.1	3.5	3.6		2.6	2.7	2.7	2.9	3.0	3.3	3.7	3.8
F	2.5	2.6	2.6	2.8	2.9	3.2	3.6	3.7		2.7	2.8	2.8	3.0	3.1	3.4	3.8	3.9
G	2.6	2.7	2.7	2.9	3.0	3.3	3.7	3.8		2.8	2.9	2.9	3.1	3.2	3.5	3.9	4.0
H	2.7	2.8	2.8	3.0	3.1	3.4	3.8	3.9		2.9	3.0	3.0	3.2	3.3	3.6	4.0	4.1
I	2.8	2.9	2.9	3.1	3.2	3.5	3.9	4.0		3.0	3.1	3.1	3.3	3.4	3.7	4.1	4.2
J	2.9	3.0	3.0	3.2	3.3	3.6	4.0	4.1		3.1	3.2	3.2	3.4	3.5	3.8	4.2	4.3
K	3.0	3.1	3.1	3.3	3.4	3.7	4.1	4.2		3.2	3.3	3.3	3.5	3.6	3.9	4.3	4.4
L	3.1	3.2	3.2	3.4	3.5	3.8	4.2	4.3		3.3	3.4	3.4	3.6	3.7	4.0	4.4	4.5
M	3.2	3.3	3.3	3.5	3.6	3.9	4.3	4.4		3.4	3.5	3.5	3.7	3.8	4.1	4.5	4.6
N	3.3	3.4	3.4	3.6	3.7	4.0	4.4	4.5		3.5	3.6	3.6	3.8	3.9	4.2	4.6	4.7
4	2.2	2.3	2.3	2.5	2.6	2.9	3.3	3.4		2.4	2.5	2.5	2.7	2.8	3.1	3.5	3.6
5	2.3	2.4	2.4	2.6	2.7	3.0	3.4	3.5		2.5	2.6	2.6	2.8	2.9	3.2	3.6	3.7
6	2.4	2.5	2.5	2.7	2.8	3.1	3.5	3.6		2.6	2.7	2.7	2.9	3.0	3.3	3.7	3.8
7	2.5	2.6	2.6	2.8	2.9	3.2	3.6	3.7		2.7	2.8	2.8	3.0	3.1	3.4	3.8	3.9
8	2.6	2.7	2.7	2.9	3.0	3.3	3.7	3.8		2.8	2.9	2.9	3.1	3.2	3.5	3.9	4.0
9	2.7	2.8	2.8	3.0	3.1	3.4	3.8	3.9		2.9	3.0	3.0	3.2	3.3	3.6	4.0	4.1
10	2.8	2.9	2.9	3.1	3.2	3.5	3.9	4.0		3.0	3.1	3.1	3.3	3.4	3.7	4.1	4.2
11	2.9	3.0	3.0	3.2	3.3	3.6	4.0	4.1		3.1	3.2	3.2	3.4	3.5	3.8	4.2	4.3
12	3.0	3.1	3.1	3.3	3.4	3.7	4.1	4.2		3.2	3.3	3.3	3.5	3.6	3.9	4.3	4.4
13	3.1	3.2	3.2	3.4	3.5	3.8	4.2	4.3		3.3	3.4	3.4	3.6	3.7	4.0	4.4	4.5
14	3.2	3.3	3.3	3.5	3.6	3.9	4.3	4.4		3.4	3.5	3.5	3.7	3.8	4.1	4.5	4.6

Key

Isle of Wight coastal cells

The Coastal Cells illustrated in Figure E1 were provided by the Environment Agency and the 1990 base sea levels were confirmed by the Environment Agency on the 07/09/09. The climate change predictions are based on the incremental rates provided in Table B.1. in PPS25

0 1 2 3 4 5 6 7 km

Scale at A3: 1:130,000

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Isle of Wight
Strategic Flood Risk Assessment

Figure E1
Coastal cells and predicted extreme sea levels

October 2018

wood.

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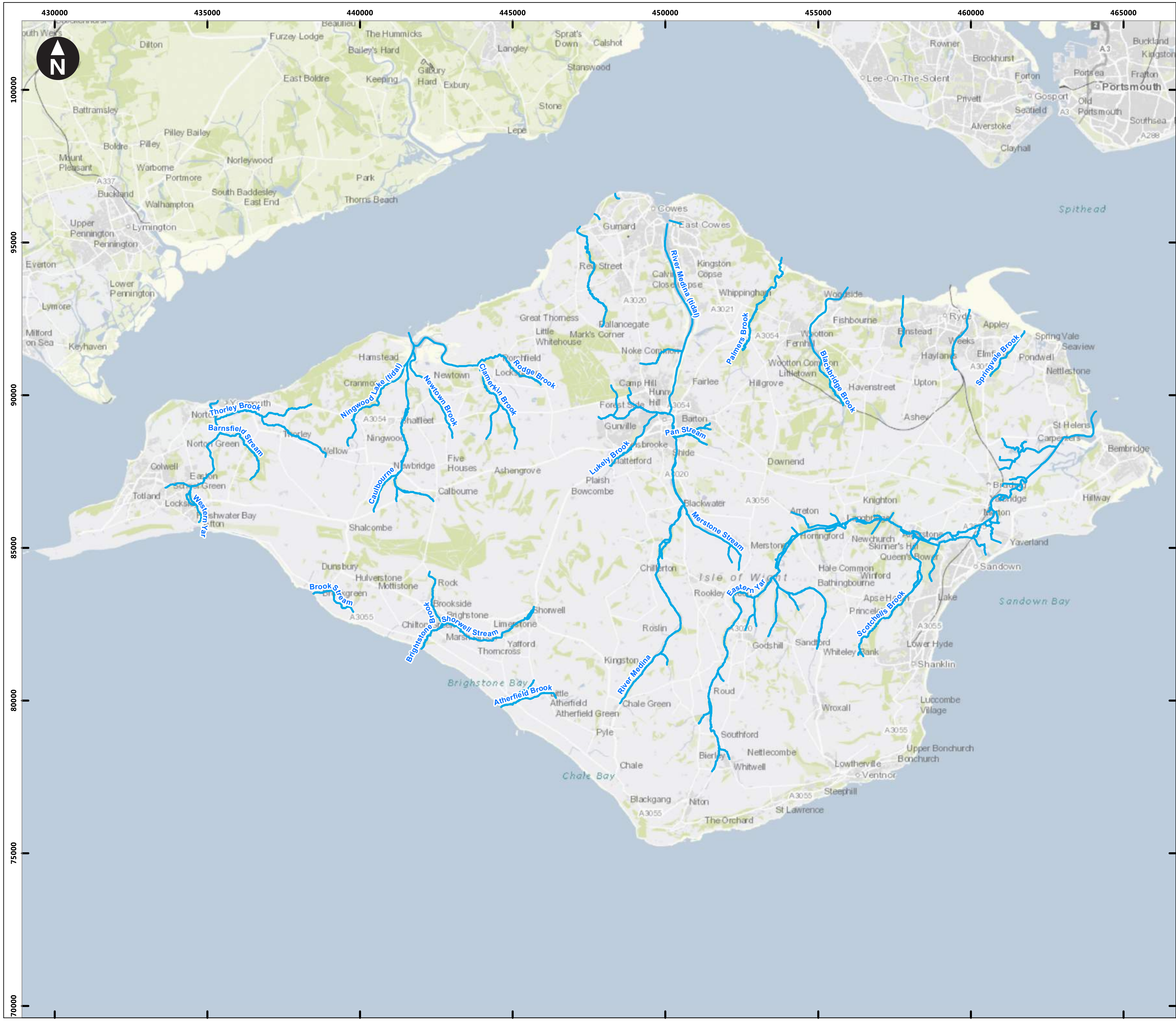

Key

Main rivers

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

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Figure A1
Main Rivers

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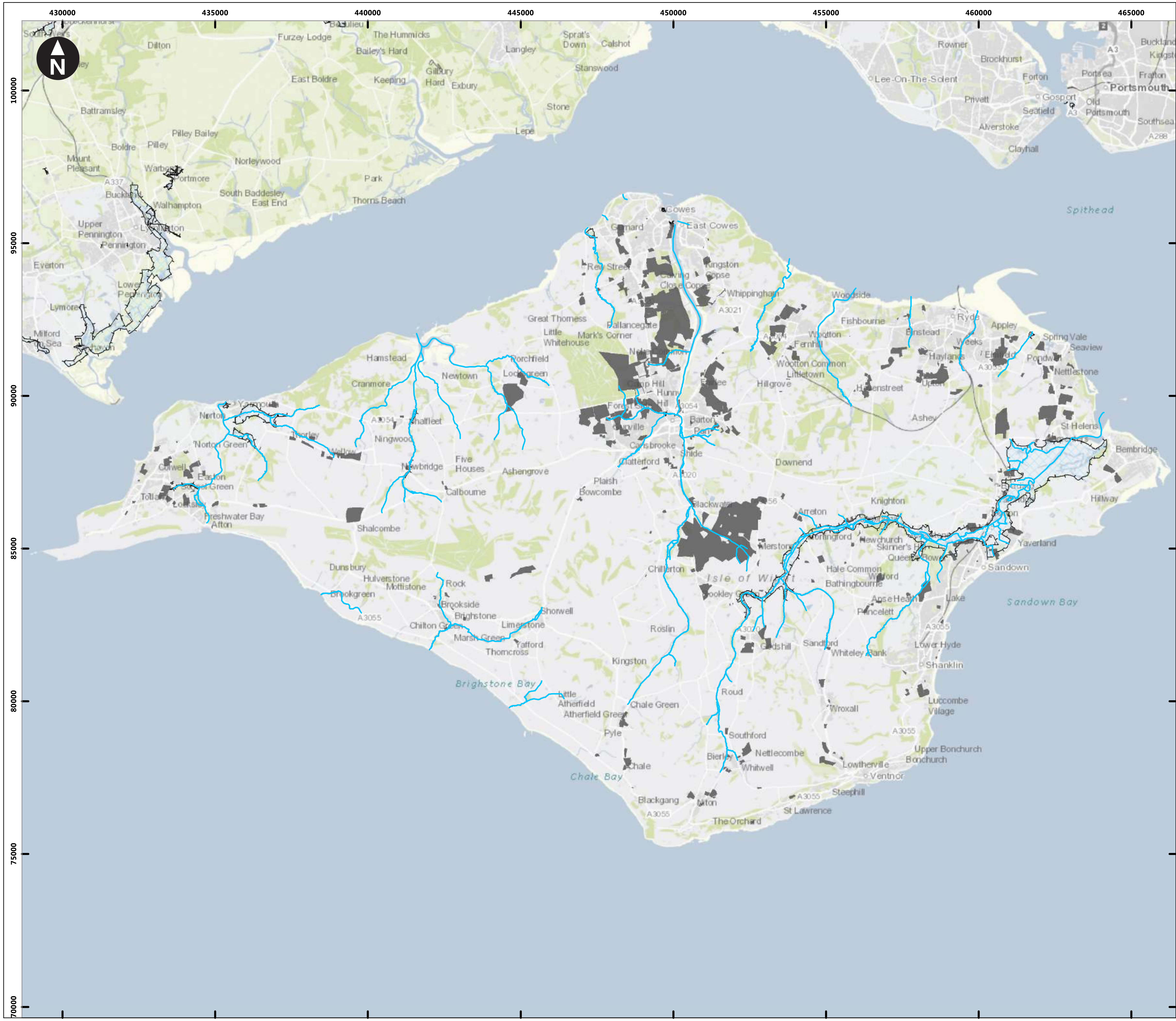

Key

Potential development sites

Main rivers

Historic flood map

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

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Isle of Wight
Strategic Flood Risk Assessment

Figure A2
Historic Flooding

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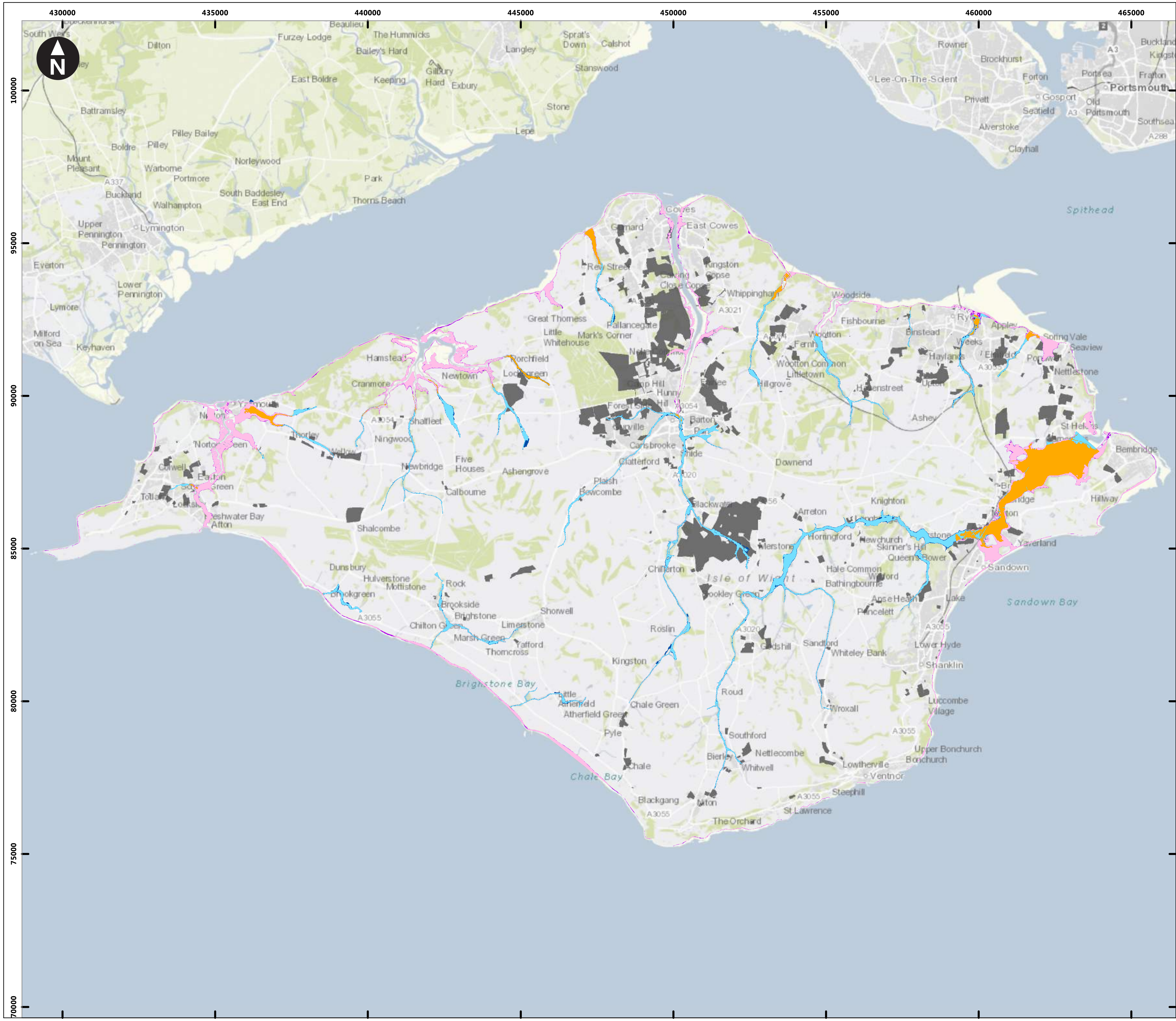

Key

- Potential development sites

Flood Zone 3

- Fluvial Models
- Tidal Models
- Fluvial / Tidal Models

Flood Zone 2

- Fluvial Models
- Tidal Models
- Fluvial / Tidal Models

Flood Zone 2 - land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.

Flood Zone 3 - land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

ISLE of WIGHT COUNCIL

Isle of Wight
Strategic Flood Risk Assessment

Figure A3
Fluvial and tidal present day Flood Zones

October 2018

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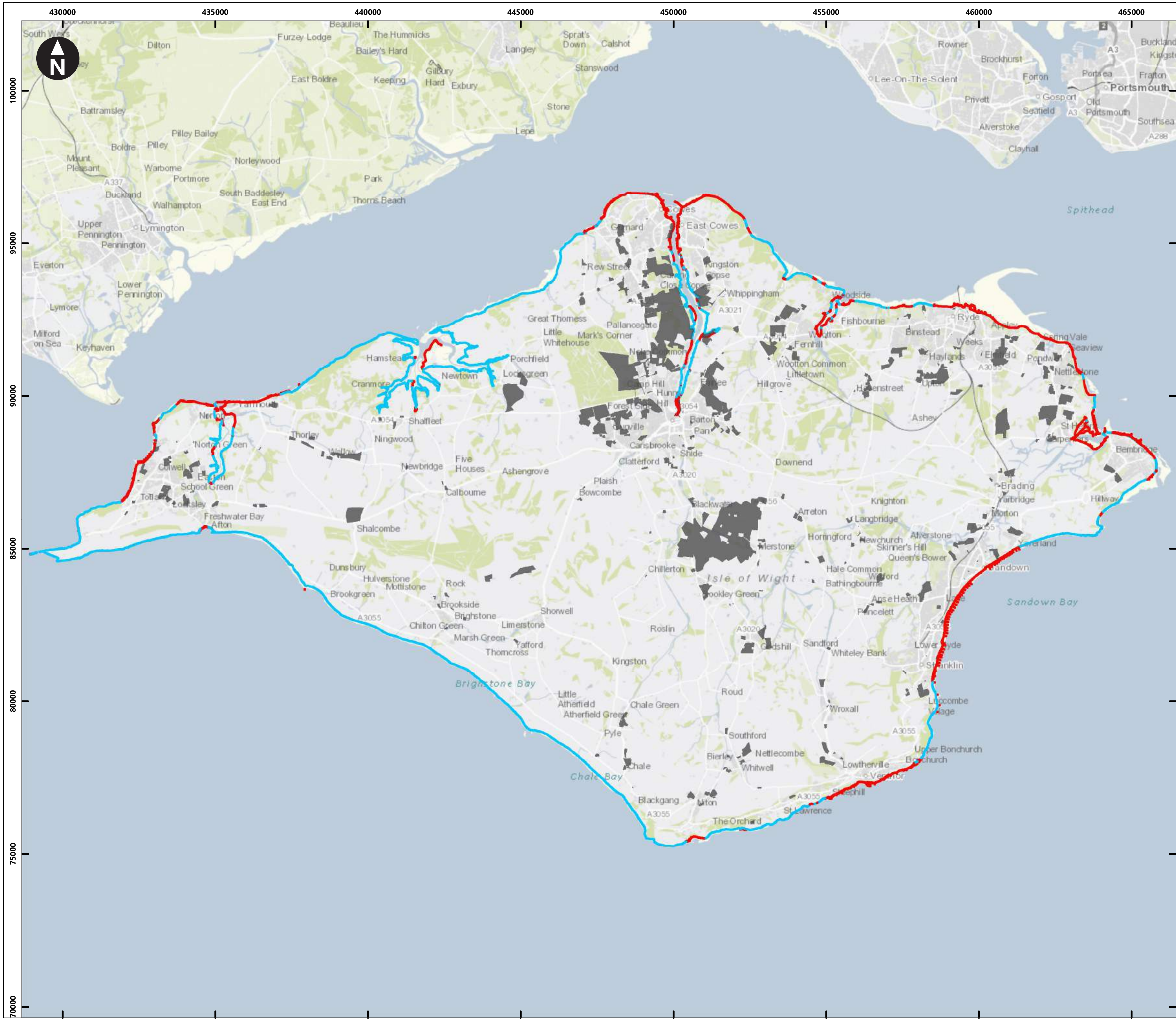

Key

■	Potential development sites
— (red)	Defended
— (blue)	Undefended

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

ISLE of WIGHT COUNCIL

Isle of Wight
Strategic Flood Risk Assessment

Figure A4
Flood defence structures

December 2018

wood.

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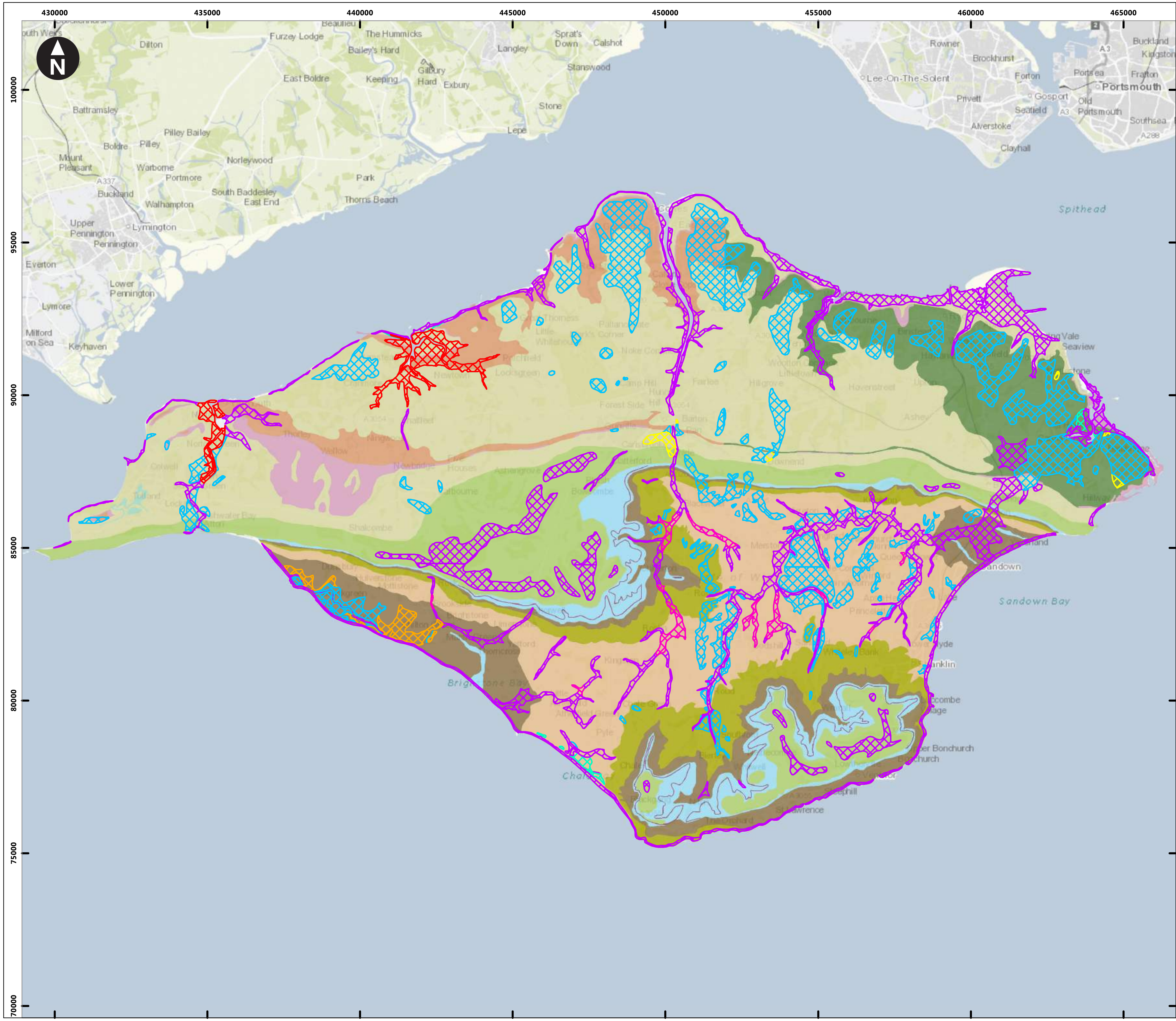

Key

Solid geology

- Calcareous mud
- Chalk
- Clay
- Clay, silt and sand
- Ferruginous sandstone
- Limestone
- Limestone and argillaceous rocks, interbedded
- Mudstone
- Sandstone
- Sandstone and chert
- Sandstone, siltstone and mudstone

Drift geology

- Clay and silt
- Clay, silt and sand
- Clay, silt, sand and gravel
- Peat
- Sand
- Sand and gravel
- Sand, silt and clay

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

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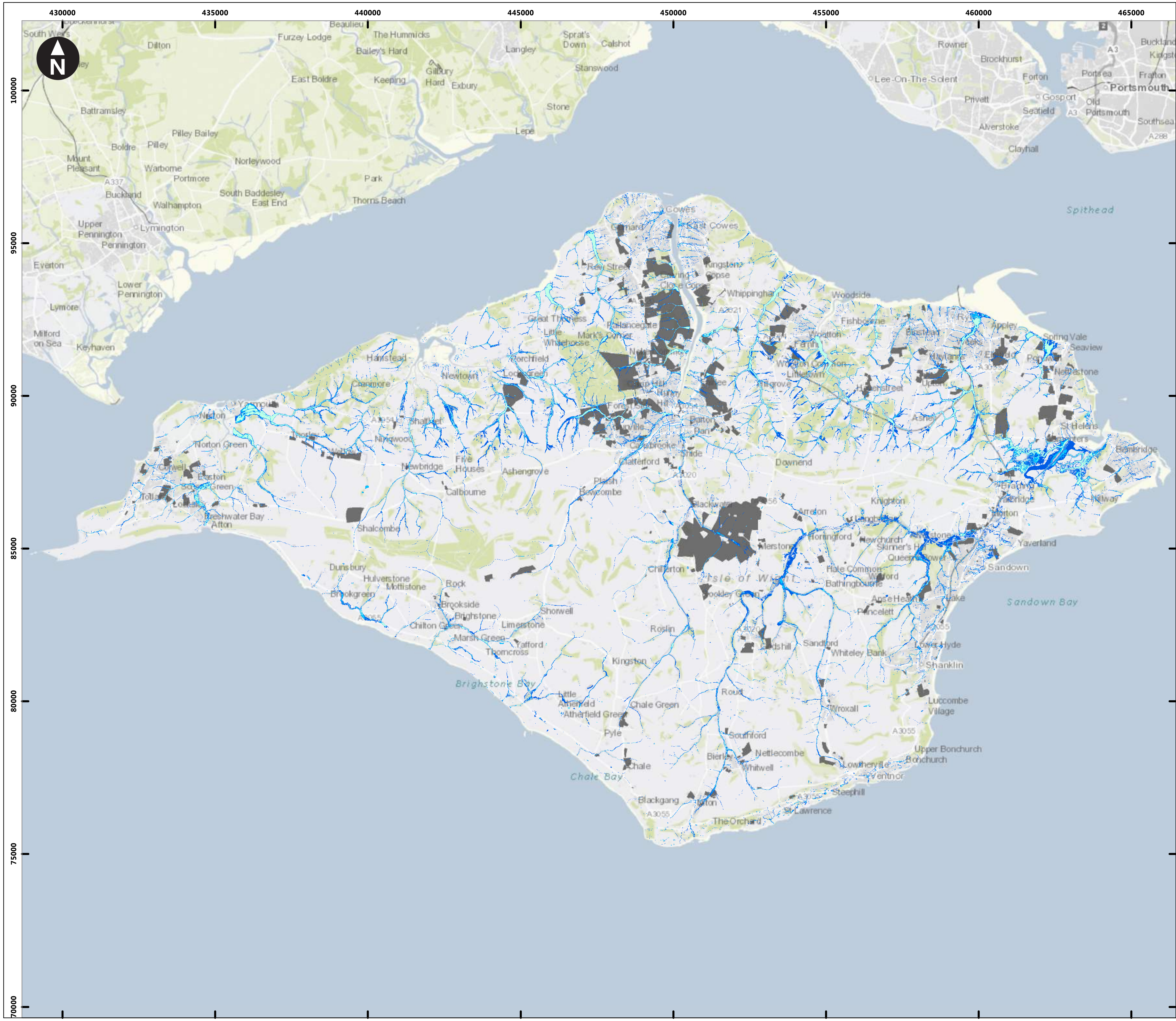
Isle of Wight
Strategic Flood Risk Assessment

Figure A5
Solid and drift geology

October 2018

wood.

G:\MODEL\PROJECTS\HM-250\41017 LDN IoW SFRA\GIS\MXD\41017Ldn026.mxd Originator: Simon.Green2



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Key

Potential development sites

Risk of flooding from Surface Water - Extent

High risk

Medium risk

Low risk

High risk – land assessed as having a 1 in 30 or greater annual probability of surface water flooding (3.33%) in any year.

Medium risk – land assessed as having between a 1 in 30 and 1 in 100 annual probability of surface water flooding (3.33% - 1%) in any year.

Low risk – land assessed as having a between a 1 in 100 and 1 in 1,000 annual probability of surface water flooding (0.1% - 1%) in any year.

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

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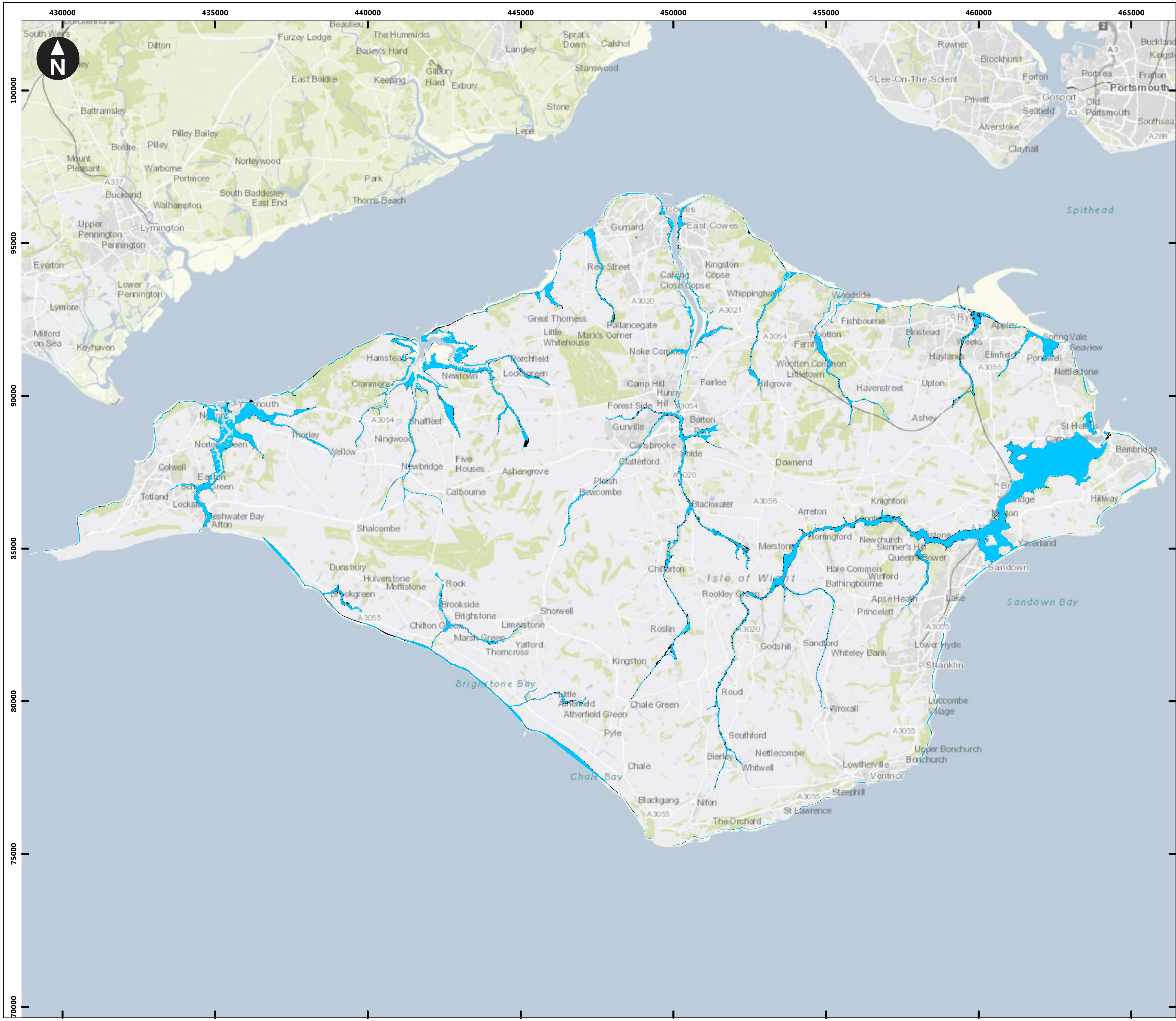
Strategic Flood Risk Assessment

Figure A6
Risk of flooding from Surface Water

October 2018

wood.



Key

- Areas potentiall sensitive to climate shcnage
- Flood Zone 3

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

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Figure A7
Areas of floodplain potentially sensitive to climate change

October 2018

wood.

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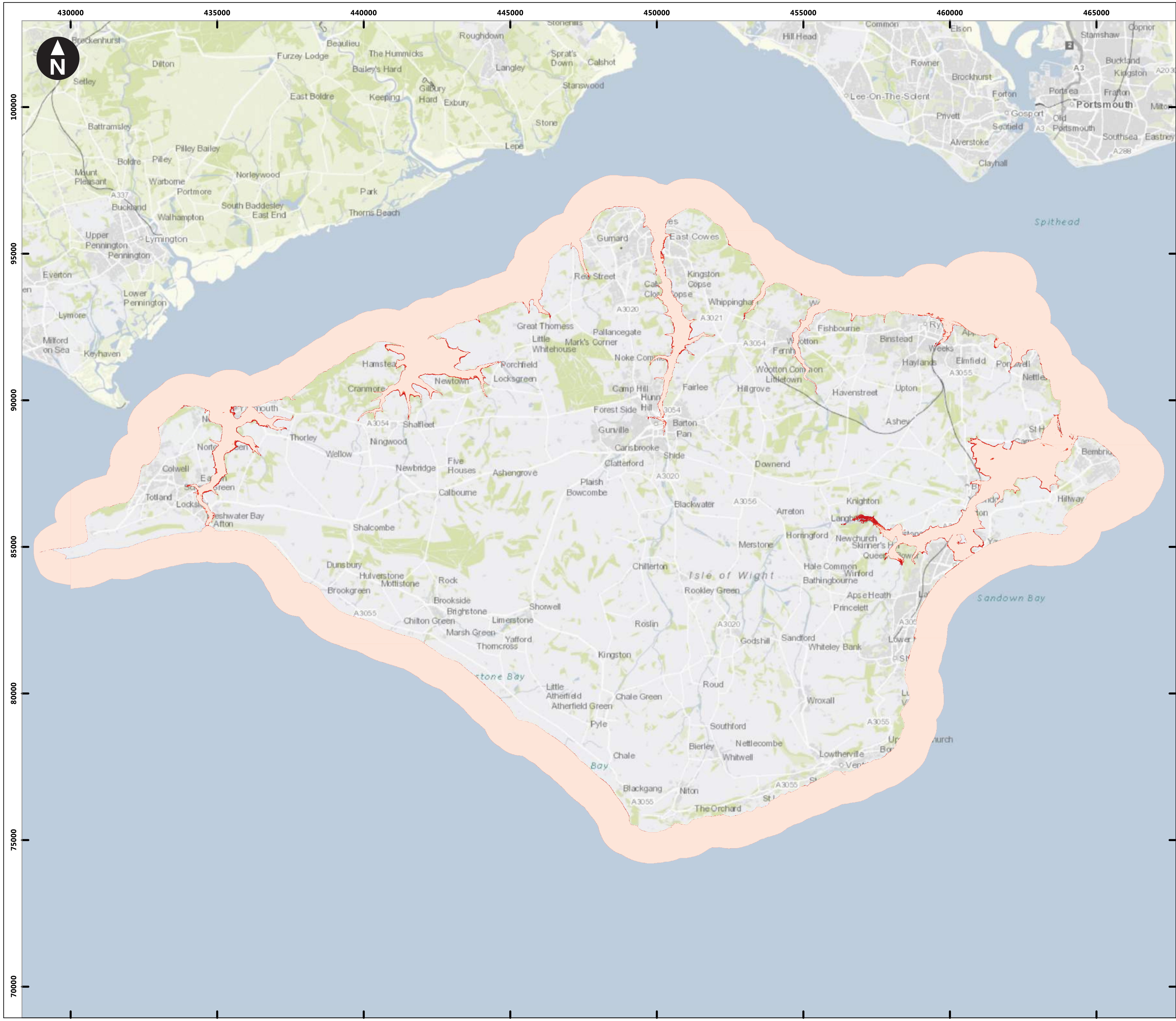

Key

Predicted 1 in 200 year Tidal Extents

- Year 2010
- Year 2045
- Year 2080
- Year 2115

0 1 2 3 4 5 6 7 km

Scale at A3: 1:125,000

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Figure A8
Tidal Flood Zone 3 - Climate Change

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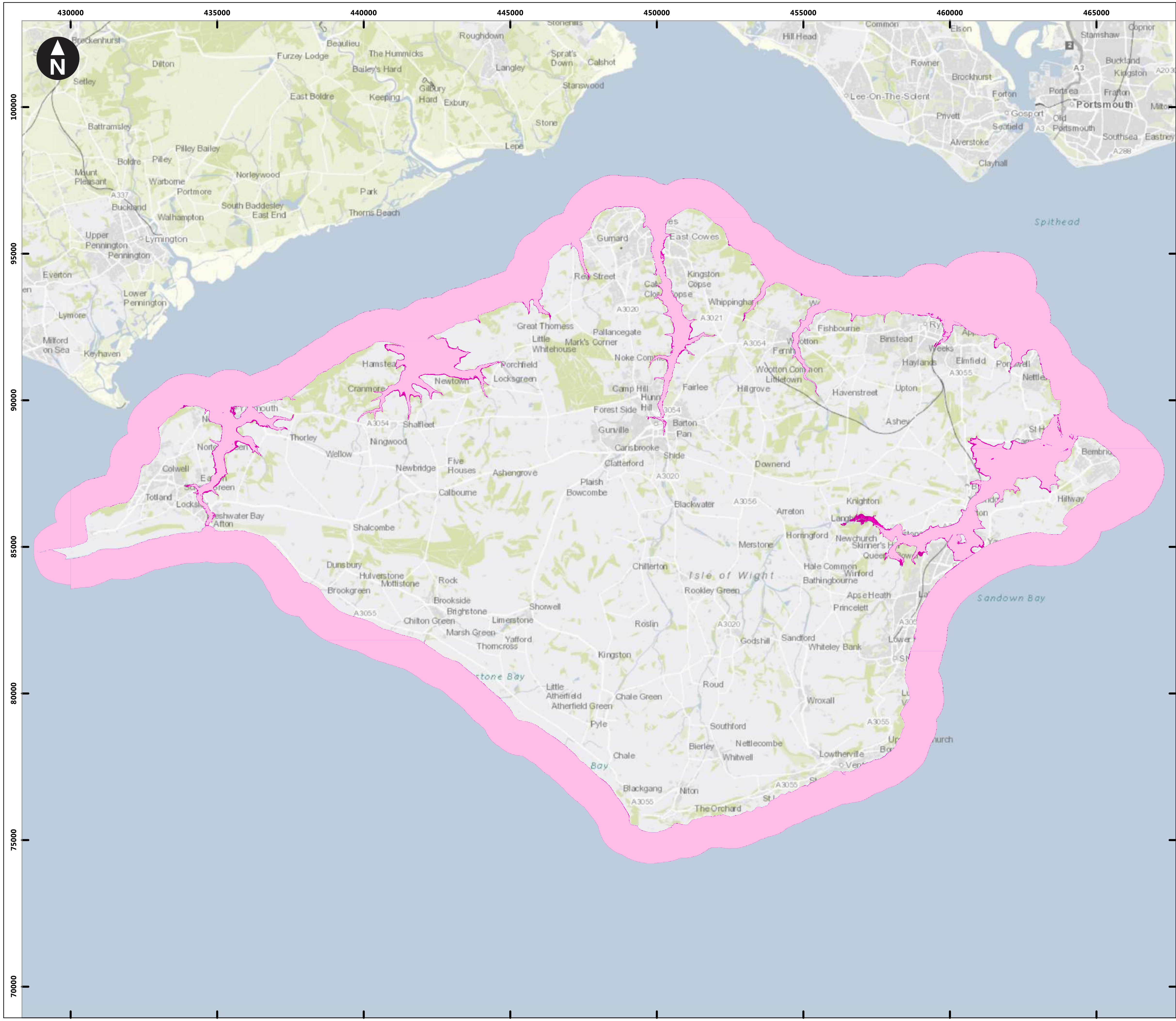
wood.

G:\MODELPROJECTS\HM-250\41017 LDN IoW SFRA\GIS\MXD\41017Ldn029.mxd Originator: Simon.Green2



Key

Predicted 1 in 1000 year Tidal Extents

- Year 2010
- Year 2045
- Year 2080
- Year 2115

0 1 2 3 4 5 6 7 km

Scale at A3: 1:125,000

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Figure A9
Tidal Flood Zone 2 - Climate Change

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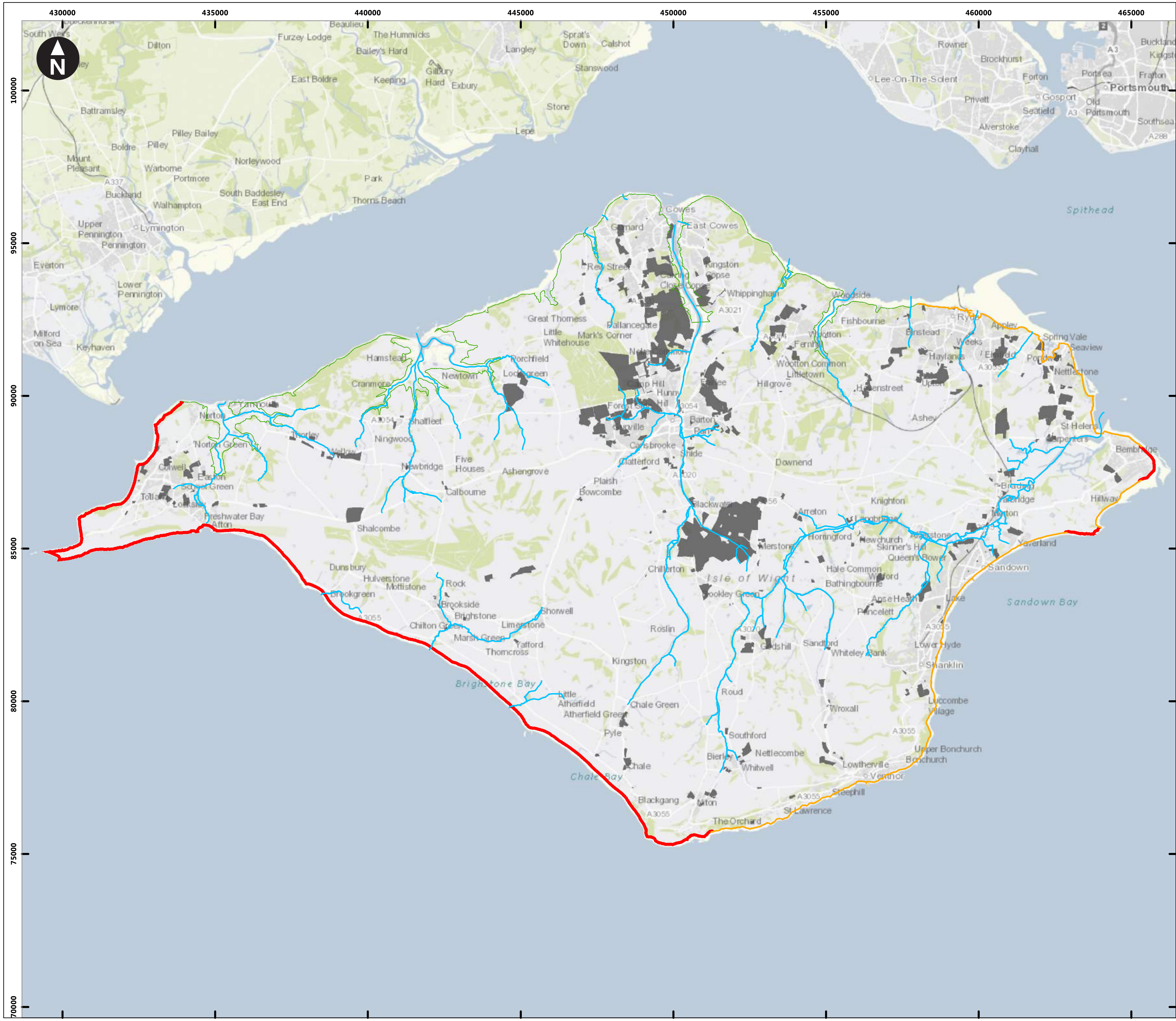
G:\MODEL\PROJECTS\HM-250\41017 LDN IoW SFRA\GIS\MXD\41017Ldn030.mxd Originator: Simon.Green2



Key

- Potential development sites
- Main rivers

Potential exposure risk

- High
- Medium
- Low

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

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Figure A10
Qualitative wind and wave exposure risk

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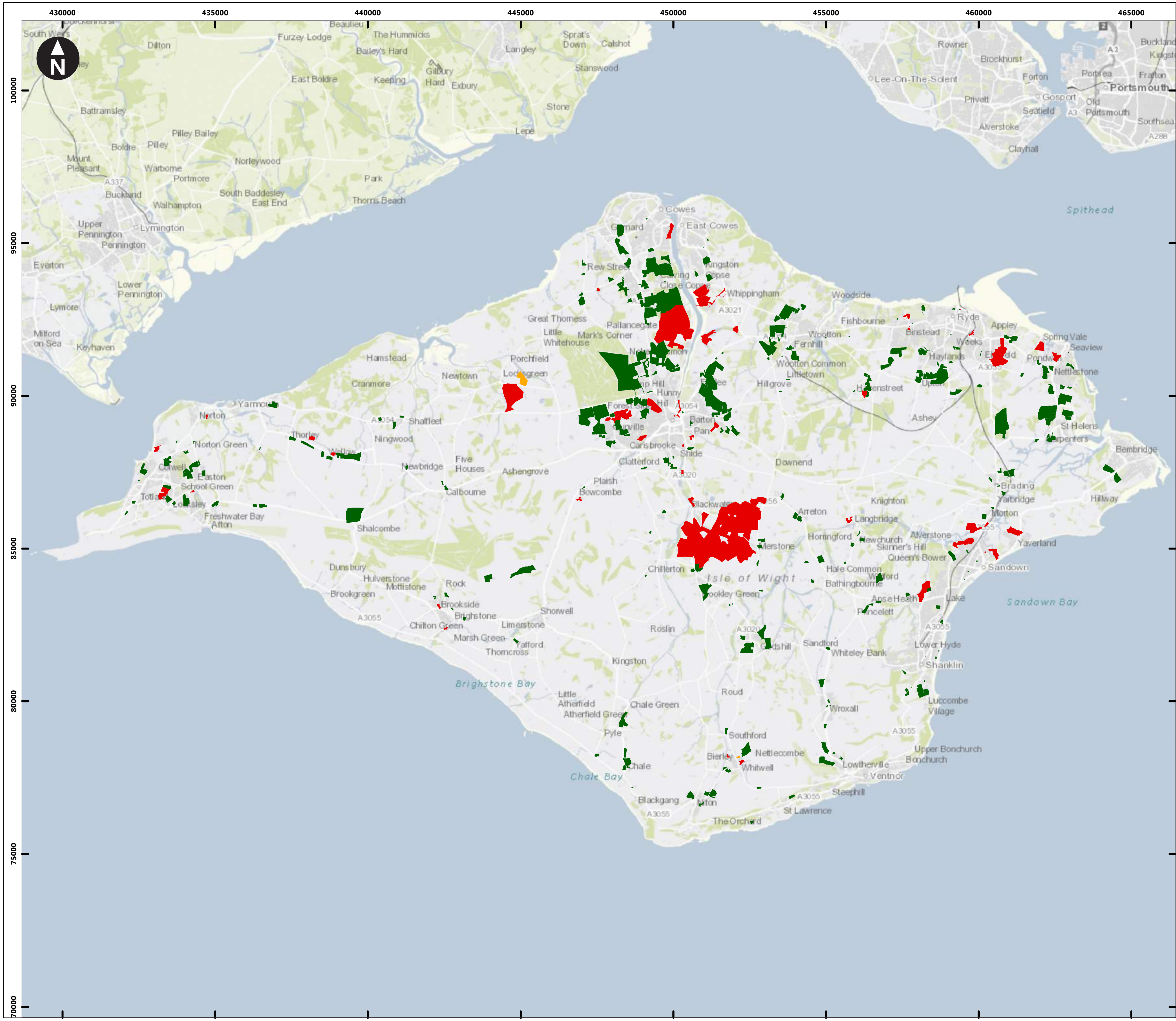
wood.

G:\MODEL\PROJECTS\HM-250\41017 LDN IoW SFRA\GIS\MXD\41017Ldn031.mxd Originator: Simon.Green2



Key

Potential development sites

- Flood Zone 1
- Flood Zone 2
- Flood Zone 3

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

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Figure A11
Potential development sites and their highest associated flood zone

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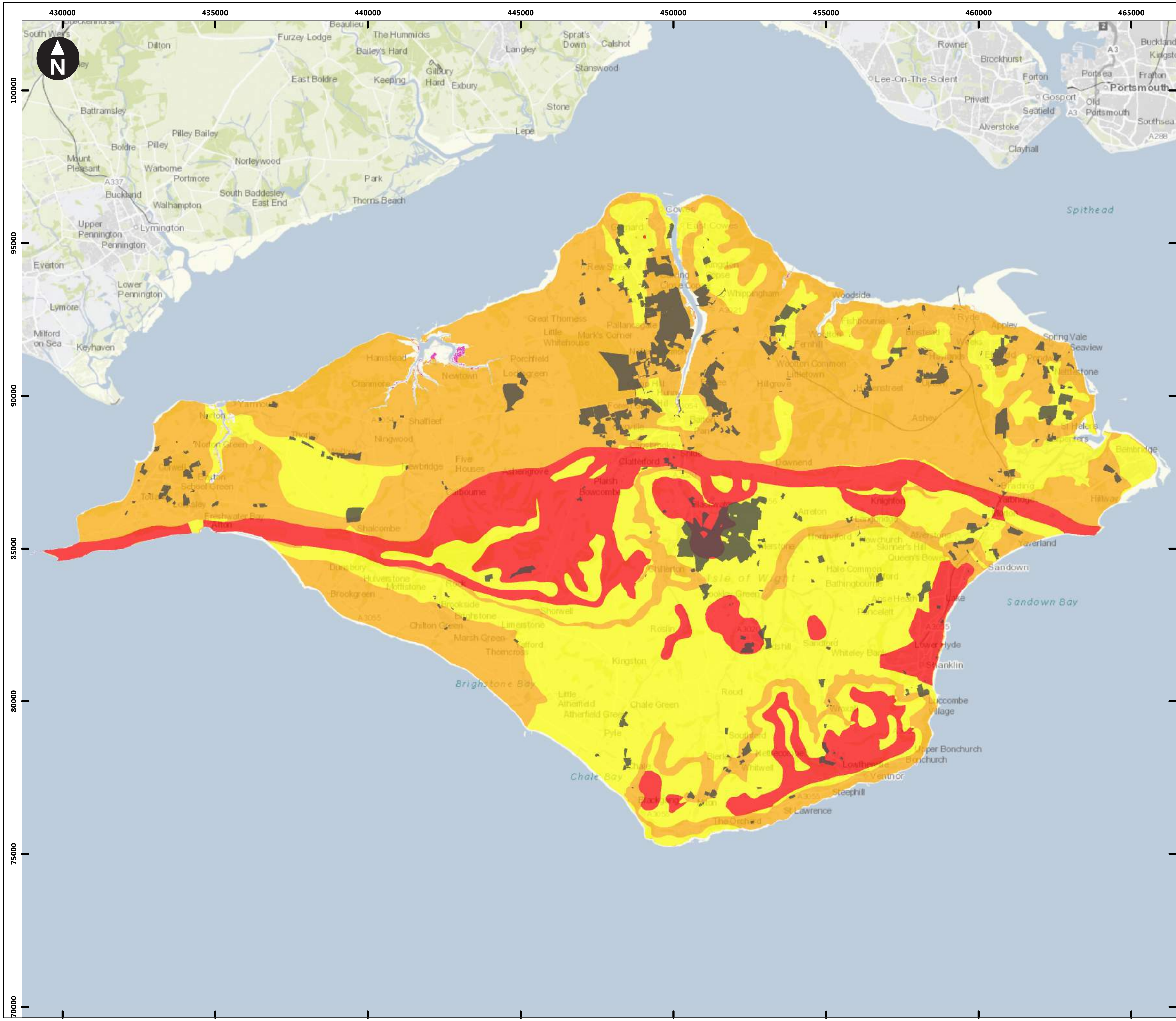

Key

Potential development sites

SuDS groundwater contamination potential

High

Low

Medium

Unknown

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

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Figure A12
SuDS groundwater contamination potential

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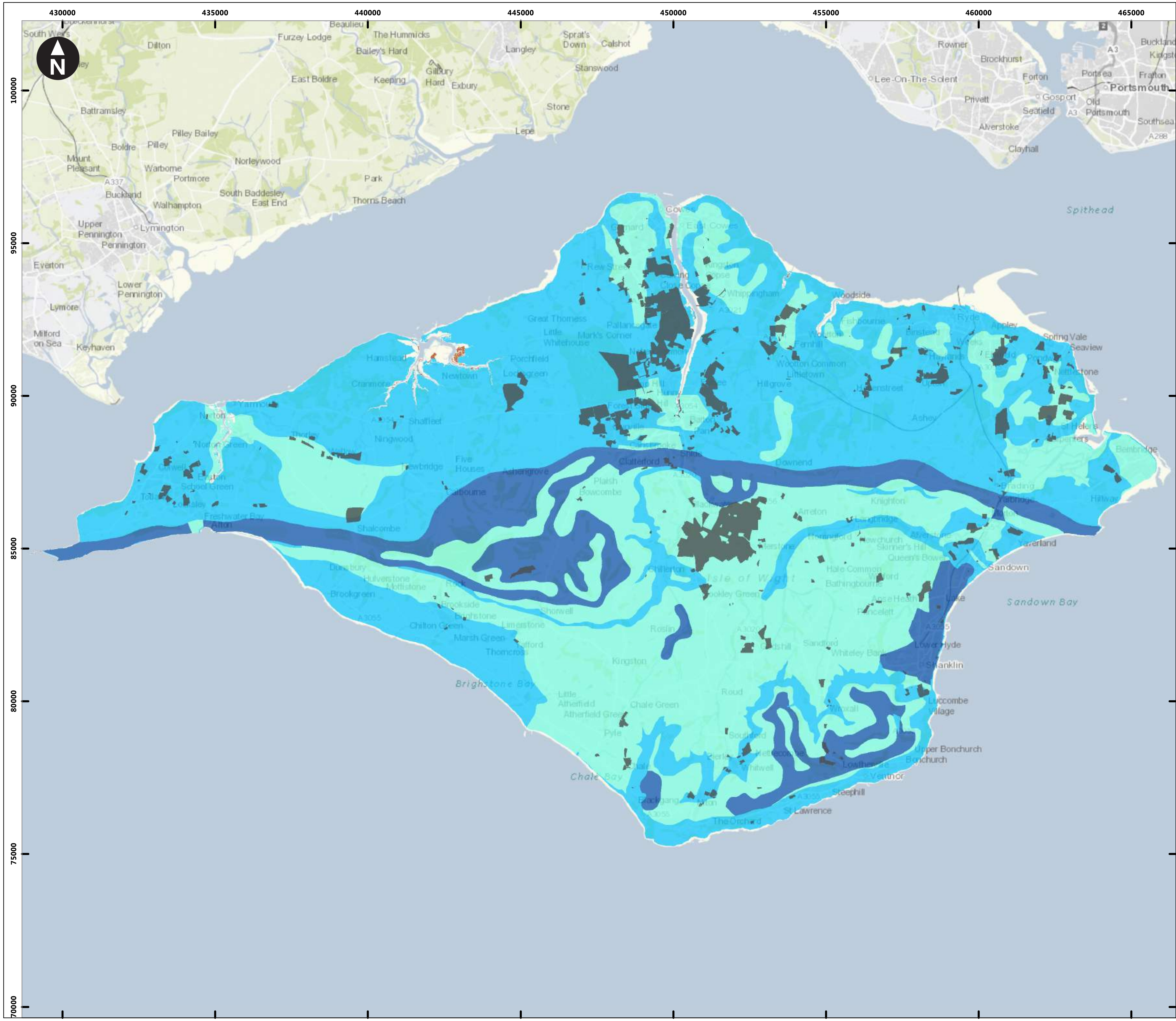
wood.

G:\MODEL\PROJECTS\HM-250\41017 LDN IoW SFRA\GIS\MXD\41017Ldn033.mxd Originator: Simon.Green2



Key

Potential development sites

SuDS infiltration potential

- High
- Low
- Medium
- Unknown

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

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Figure A13
SuDS infiltration potential

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wood.

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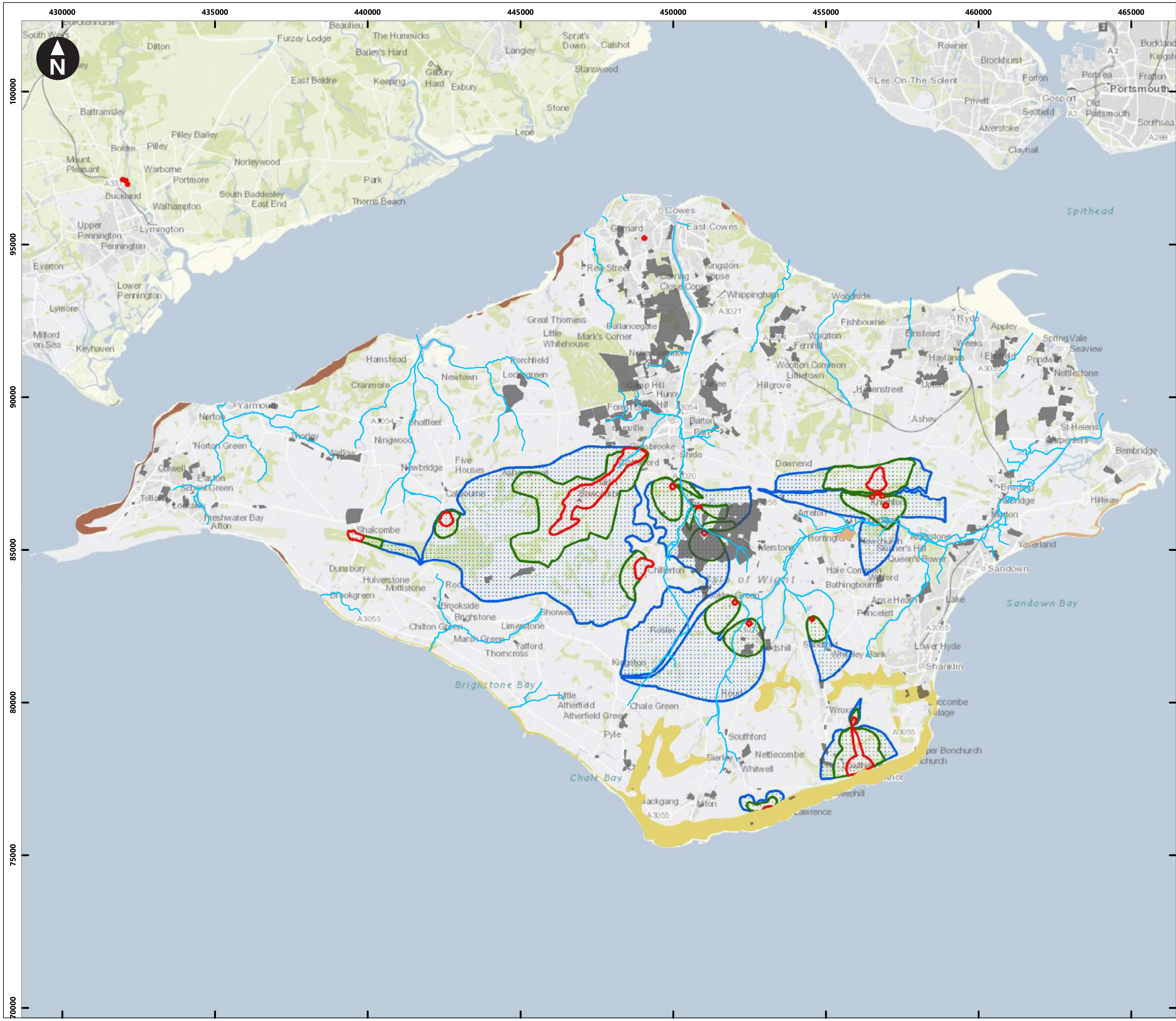

Key

Potential development areas

Main rivers

Mass movement

Clay

Rock

Sandstone and mudstone

Source Protection Zone

Zone I

Zone II

Zone III

0 1 2 3 4 5 6 7 km

Scale at A3: 1:120,000

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Strategic Flood Risk Assessment

Figure A14
Source Protection Zones (SPZs) and areas of mass movement

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wood.

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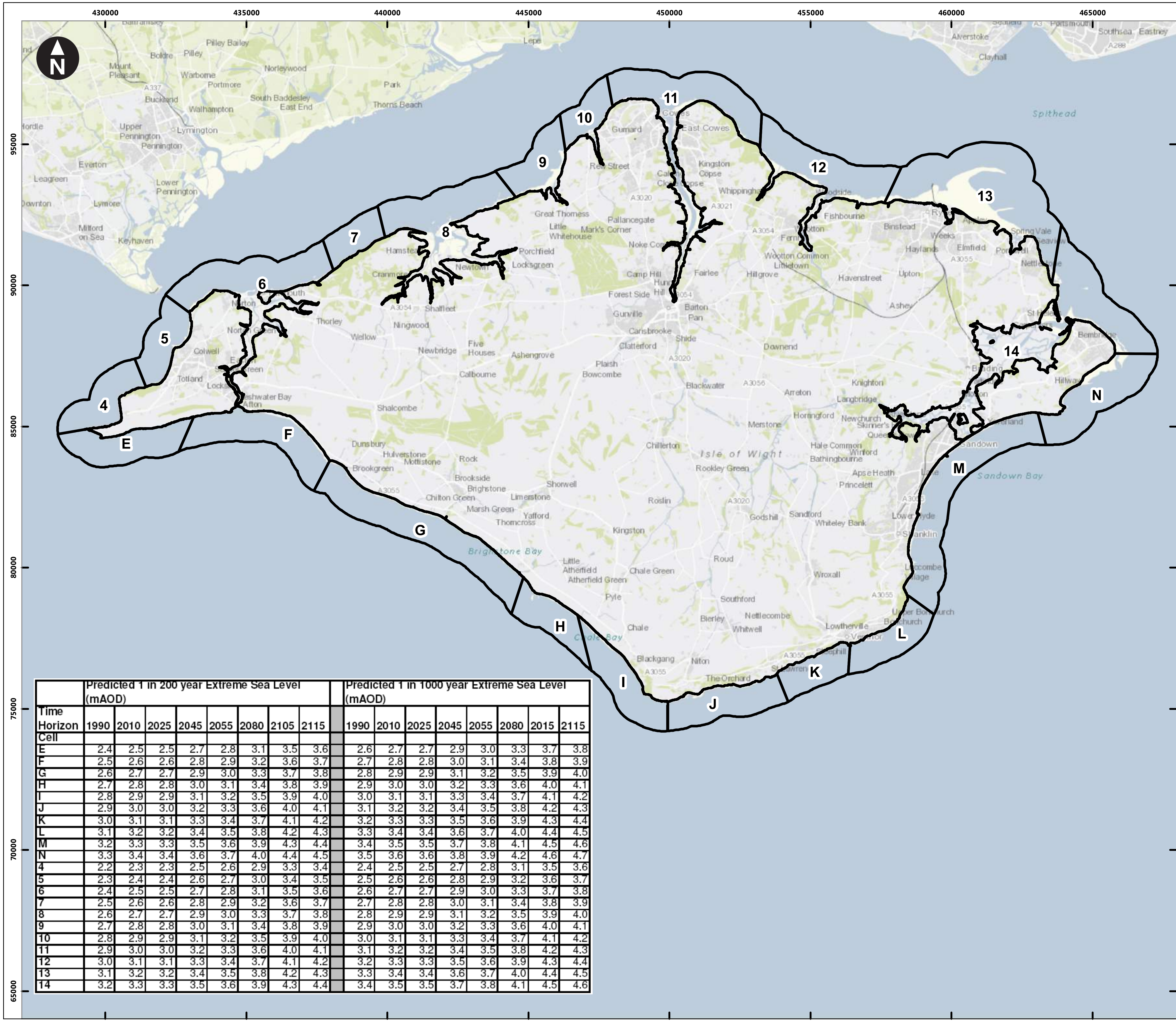

Time Horizon	Predicted 1 in 200 year Extreme Sea Level (mAOD)									Predicted 1 in 1000 year Extreme Sea Level (mAOD)							
	1990	2010	2025	2045	2055	2080	2105	2115		1990	2010	2025	2045	2055	2080	2015	2115
Cell																	
E	2.4	2.5	2.5	2.7	2.8	3.1	3.5	3.6		2.6	2.7	2.7	2.9	3.0	3.3	3.7	3.8
F	2.5	2.6	2.6	2.8	2.9	3.2	3.6	3.7		2.7	2.8	2.8	3.0	3.1	3.4	3.8	3.9
G	2.6	2.7	2.7	2.9	3.0	3.3	3.7	3.8		2.8	2.9	2.9	3.1	3.2	3.5	3.9	4.0
H	2.7	2.8	2.8	3.0	3.1	3.4	3.8	3.9		2.9	3.0	3.0	3.2	3.3	3.6	4.0	4.1
I	2.8	2.9	2.9	3.1	3.2	3.5	3.9	4.0		3.0	3.1	3.1	3.3	3.4	3.7	4.1	4.2
J	2.9	3.0	3.0	3.2	3.3	3.6	4.0	4.1		3.1	3.2	3.2	3.4	3.5	3.8	4.2	4.3
K	3.0	3.1	3.1	3.3	3.4	3.7	4.1	4.2		3.2	3.3	3.3	3.5	3.6	3.9	4.3	4.4
L	3.1	3.2	3.2	3.4	3.5	3.8	4.2	4.3		3.3	3.4	3.4	3.6	3.7	4.0	4.4	4.5
M	3.2	3.3	3.3	3.5	3.6	3.9	4.3	4.4		3.4	3.5	3.5	3.7	3.8	4.1	4.5	4.6
N	3.3	3.4	3.4	3.6	3.7	4.0	4.4	4.5		3.5	3.6	3.6	3.8	3.9	4.2	4.6	4.7
4	2.2	2.3	2.3	2.5	2.6	2.9	3.3	3.4		2.4	2.5	2.5	2.7	2.8	3.1	3.5	3.6
5	2.3	2.4	2.4	2.6	2.7	3.0	3.4	3.5		2.5	2.6	2.6	2.8	2.9	3.2	3.6	3.7
6	2.4	2.5	2.5	2.7	2.8	3.1	3.5	3.6		2.6	2.7	2.7	2.9	3.0	3.3	3.7	3.8
7	2.5	2.6	2.6	2.8	2.9	3.2	3.6	3.7		2.7	2.8	2.8	3.0	3.1	3.4	3.8	3.9
8	2.6	2.7	2.7	2.9	3.0	3.3	3.7	3.8		2.8	2.9	2.9	3.1	3.2	3.5	3.9	4.0
9	2.7	2.8	2.8	3.0	3.1	3.4	3.8	3.9		2.9	3.0	3.0	3.2	3.3	3.6	4.0	4.1
10	2.8	2.9	2.9	3.1	3.2	3.5	3.9	4.0		3.0	3.1	3.1	3.3	3.4	3.7	4.1	4.2
11	2.9	3.0	3.0	3.2	3.3	3.6	4.0	4.1		3.1	3.2	3.2	3.4	3.5	3.8	4.2	4.3
12	3.0	3.1	3.1	3.3	3.4	3.7	4.1	4.2		3.2	3.3	3.3	3.5	3.6	3.9	4.3	4.4
13	3.1	3.2	3.2	3.4	3.5	3.8	4.2	4.3		3.3	3.4	3.4	3.6	3.7	4.0	4.4	4.5
14	3.2	3.3	3.3	3.5	3.6	3.9	4.3	4.4		3.4	3.5	3.5	3.7	3.8	4.1	4.5	4.6

Key

Isle of Wight coastal cells

The Coastal Cells illustrated in Figure E1 were provided by the Environment Agency and the 1990 base sea levels were confirmed by the Environment Agency on the 07/09/09. The climate change predictions are based on the incremental rates provided in Table B.1. in PPS25

0 1 2 3 4 5 6 7 km

Scale at A3: 1:130,000

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Strategic Flood Risk Assessment

Figure E1
Coastal cells and predicted extreme sea levels

October 2018

wood.